United States Department of Agriculture

Soil Conservation Service

In cooperation with the University of Nebraska, Conservation and Survey Division

Soil Survey of Loup County, Nebraska

How To Use This Soil Survey

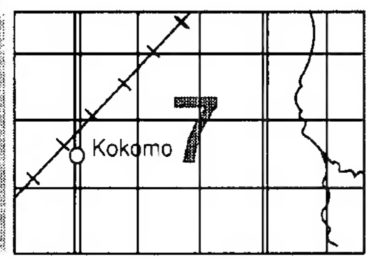
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

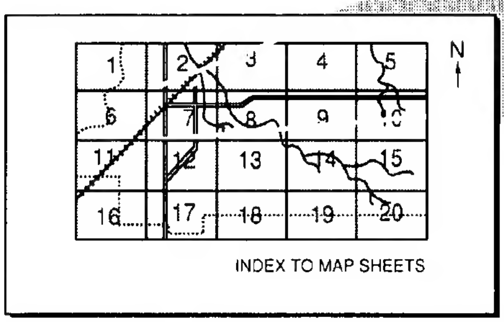
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

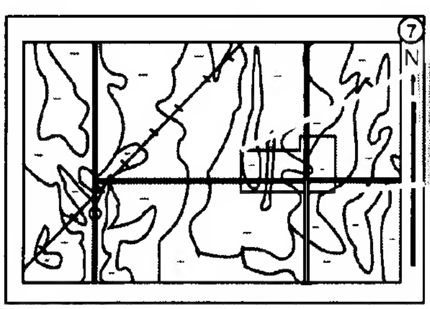


MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



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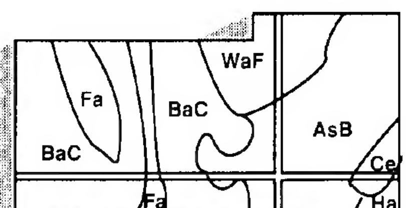

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the Lower Loup Natural Resources District (NRD).

The Lower Loup NRD accelerated completion of the survey by providing financial assistance to employ a soil scientist. The Lower Loup NRD, the Loup County Commissioners, and the Old West Regional Commission provided financial assistance to fund aerial photography.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: An area of the Almeria-Calamus-Bolent association along the Calamus River. This area is used for range and hay.

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Issued October 1990

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Foreword

This soil survey contains information that can be used in land-planning programs in Loup County, Nebraska. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Sherman L. Lewis
State Conservationist
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Soil Survey of
Loup County, Nebraska

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United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the University of Nebraska, Conservation and Survey Division

Loup County is in the north-central part of Nebraska (fig. 1). It is about 24 miles square. It has a total area of 367,392 acres. It is bordered on the south by Custer County, on the west by Blaine County, on the north by Brown, Rock, and Holt Counties, and on the east by Garfield County. Taylor, the only incorporated town and the county seat, is in the southeastern part of the county.

Ranching is the main source of income in Loup County. More than 90 percent of the survey area has a permanent grass cover and is used as range or hayland. About 6 percent of the county is used as cropland. Ranches are large. Most are owned by the operators. Some ranches or grazing lands are leased from absentee owners or retired ranchers. Raising livestock, mainly cow-calf herds, is the largest enterprise in the county. General livestock farming is mostly in the valley along the North Loup River and in the loess-sand transition area. Livestock on farms consists mainly of beef cattle and hogs and a few dairy cattle or sheep. The main crops are corn and alfalfa. Some grain is sold as a cash-crop. The rest of the grain and forage is used for livestock feed.

In normal years, the lack of seasonal rainfall limits crop production under dryland farming. Gravity irrigation systems are used in areas on the stream terraces south of the North Loup River. The irrigation water is diverted from the river and is delivered by the Taylor-Ord Canal. In places deep wells are used to supplement water from the canal. Center-pivot sprinkler systems are used on the sandy soils throughout the county, mainly in the valleys along the North Loup and Calamus Rivers. The irrigation water for these systems is drawn mostly from deep wells.

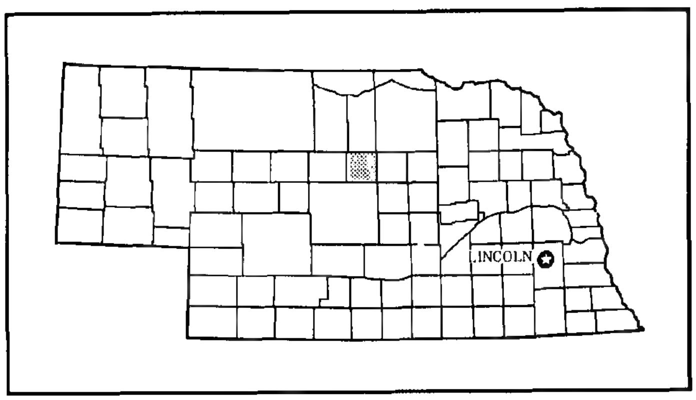

Figure 1.—Location of Loup County in Nebraska.

Loup County is situated at the southeastern edge of the Nebraska Sandhills. The soils in the county formed almost entirely in sandy eolian material. The sand forms successions of rolling hills and valleys, and the dunes are generally oriented in a northwesterly to southeasterly direction. Along the extreme southern edge of the county is an area of loess uplands deeply dissected by drainageways. The soils in this area are mostly silty. Outlying areas of loess mixed with sand are in scattered areas throughout the sandhills in the southern half of the county. The soils in these areas range from sandy to silty. The soils on bottom land are

sandy or loamy, depending on the source of the alluvial material.

The county is nearly level or gently sloping in the river valleys and nearly level to very steep in the sandhills. Most of the soils in the sandhills are excessively drained, and the soils in the valleys are excessively drained to very poorly drained.

Loup County does not have railroad service. U.S. Highway 183 and Nebraska Highway 91 provide the north-south and east-west routes, respectively, through the county. Gravel or dirt roads are on some section lines in the farmed areas of the county. Roads in the sandhill areas are scarce, and trails provide access where needed.

The livestock and grain produced in the county are transported to markets outside the county. Farm equipment dealers and other agribusinesses are located in Taylor, in nearby Burwell and Sargent, and in other surrounding communities.

This soil survey updates the survey of Loup County published in 1937 *(1)*. It gives additional information and has larger maps, which show the soils in greater detail.

General Nature of the County

This section provides general information about Loup County. It describes history and development; climate; geology and ground water; physiography and drainage; and trends in ranching, farming, and land use.

History and Development

French explorers were the first Europeans to travel through the area now known as Loup County. The Pawnee Indians used this area as hunting grounds. Trappers came to the area for the abundant game. Cattlemen were later attracted by the lush grass and abundant water supply. The first settlers arrived about 1873. They settled a few miles southeast of Taylor. The first ranch was started in 1879, in the western part of the county *(5)*.

Loup County was organized in 1883. It was named for the North Loup River, which passes through the county. The word "Loup" is derived from the native Loup Indians, or "wolf people." Several towns were started in Loup County. Kent, southeast of the present town of Taylor, was established in 1873. Taylor was organized in 1883. Almeria, northwest of Taylor, was founded in the early 1880's, and Clarks Point was established about halfway between Almeria and Taylor. Of these towns, only Almeria and Taylor remain.

By 1890, most of the land in Loup County was homesteaded. The early settlers, who came mainly from the Eastern United States, were unprepared for the climatic and soil conditions. In the early years of settlement, cultivating land in the sandhills resulted in almost total crop failure. Many farmers were forced to leave the land, and cattlemen acquired most of the homesteads in the sandhills.

During the droughts of the mid-1890's, eight irrigation projects were planned, and four were actually built. They operated until the droughts ended. The projects were discontinued because they were not profitable. The Taylor-Ord Canal, which was built in the 1940's, continues to supply irrigation water to farmland in Garfield, Loup, and Valley Counties.

The population of Loup County reached a peak in 1910, when it was 2,188. It has declined since then, and in 1980, it was 859.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Chambers, Nebraska, in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 23 degrees F, and the average daily minimum temperature is 12 degrees. The lowest temperature on record, which occurred at Chamberson December 31, 1967, is -34 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred at Chambers on July 11, 1954, is 108 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 21.62 inches. Of this, about 17 inches, or nearly 80 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14 inches. The heaviest 1-day rainfall during the period of

record was 3.40 inches at Chambers on October 3, 1951. Thunderstorms occur on about 49 days each year. Tornados and severe thunderstorms, some of which are accompanied by hail, occur occasionally. These storms are local in extent and of short duration. They cause damage in scattered small areas.

The average seasonal snowfall is about 29 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 13 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 14 miles per hour, in spring.

Geology and Ground Water

The bedrock in Loup County is part of the Ogallala Formation of the Miocene Era. Quaternary-age deposits mantle the bedrock throughout the county.

The Ogallala Formation consists of beds of sand, lime-cemented sandstone, sand and gravel, and silt that has some limy zones. The unconsolidated quaternary deposits consist of loess, sandy eolian material, and alluvium *(4)*.

Sandy eolian material covers about 90 percent of the county. About 80 percent of the county has dune topography. The dunes consist of fine sand. Sandy and silty material is in many of the interdune valleys. The present dune topography probably formed during arid intervals in recent Quaternary age. Uplands in the southeast corner of the county are capped with Peoria loess. Sandy alluvium is along the major streams. Silty alluvium is on stream terraces bordering the loess-capped uplands and along the intermittent drainageways in the uplands.

The Calamus and North Loup Rivers cross the county in a generally northwest to southeast direction. Precipitation is quickly absorbed in the sandy soils, and about 80 percent of the county has no defined drainage pattern.

Wells in both the Quaternary deposits and the Ogallala Formation provide water for domestic, livestock, and irrigation uses. Most of the wells, however, draw from the Quaternary deposits. The ground water throughout the county is of good quality and in adequate supply for all purposes. Water from shallow wells in the sandhills is low in content of dissolved minerals and is soft, but water from deep wells is hard.

Drainage from feedlots, septic tanks, and other types of waste disposal can contaminate ground water. Shallow wells are more likely to become contaminated than deep wells.

Physiography and Drainage

Loup County is in the Great Plains physiographic province. Most of the county is in the Nebraska Sandhills. The southern edge of the county is in the Central Nebraska Loess Hills. The surface features are mostly the result of wind and water action.

The dominant feature of the county is the sandhill topography, which typically consists of a succession of stabilized rolling dunes. The crest of the dunes generally is about 10 to 100 feet above the valley floor. The surface is relieved by interspersed areas of nearly level or very gently sloping valleys. In places a high water table provides subirrigation and creates wetlands or shallow lakes in some of the low lying areas. The surface drainage pattern in the sandhills is well defined only in areas along the Calamus and North Loup Rivers and their tributaries.

The loess mantle on the extreme southern edge of the county is deeply dissected by tributaries of the North Loup River. The ridgetops and divides are about 50 to 125 feet above the valley floor. The surface drainage pattern is well defined.

A loess-sand transition area is between the loess hills and sandhills. It is characterized by features of both landscapes. The area consists of nearly level to steep, silty and sandy soils on uplands and outliers of sandhills. Low ridges formed by wind are common. The surface drainage pattern is well defined. A few small areas have poorly defined drainageways, and runoff is sometimes ponded in shallow depressions. Areas of this landscape are intermixed with the sandhills in the southeastern part of the county, between the North Loup and Calamus Rivers.

The alluvial valleys consist of bottom land and stream terraces along the larger streams. The bottom land is broadest along the North Loup and Calamus Rivers, where it is ⅛- to ¾-mile wide. The nearly level bottom land is modified in places by shallow stream channels. The seasonal high water table in the areas of the bottom land provides subirrigation. The bottom land is subject to occasional or frequent flooding. Stream

terraces are most extensive in the valley of the North Loup River. They are about 10 to 30 feet above the level of the stream. They are nearly level or very gently sloping. In a few places on the stream terraces, the sand has been reworked by the wind into low hummocks. The seasonal high water table in this area is typically at a depth of 10 feet or more. Surface runoff is slow because natural drainageways are not well defined or have been modified by land grading.

Loup County is drained by the North Loup and Calamus Rivers and their tributaries. The major streams flow toward the southeast and south. Skull Creek, Bloody Creek, Gracie Creek, and Dry Creek drain into the Calamus River from the north. Chesbra Creek flows into the North Loup River from the south. Cedar Creek flows into the North Loup River from the north. The North Loup River, the Calamus River, Skull Creek, and Bloody Creek are permanent streams. The others are dry most of the time.

The highest elevation is about 2,700 feet in the loess-sand transition area southeast of Almeria, near the Custer-Loup county line. The lowest elevation is about 2,175 feet on the bottom land along the Calamus River, at the Loup-Garfield county line. The elevation is 2,269 feet at Taylor and 2,336 feet at Almeria. The general slope of the county is to the south and east.

Trends in Ranching, Farming, and Land Use

Ranching has been the major economic enterprise in Loup County since the area was settled. According to Nebraska Agricultural Statistics, the number of farms and ranches in the county decreased from 200 in 1962 to 150 in 1982. The decline has been regular and constant over the 20-year period. The sandhill ranches are typically cow-calf operations, and the farms are a combination of cash-grain and livestock enterprises. The acreage used as cropland has remained fairly constant during the 20-year period, but the acreage of irrigated cropland has increased.

The number of livestock tends to fluctuate on a yearly basis. According to Nebraska Agricultural Statistics, the total number of cattle increased from 28,910 in 1962 to 38,000 in 1982. Of this total, the number of dairy cattle decreased from 1,230 in 1962 to 150 in 1982. The number of hogs has remained fairly constant, at 4,200 in 1962 and 4,000 in 1982. The number of sheep has been constant, totaling 200 in 1982.

The major change in the agriculture of Loup County in recent years has been an increase in the acreage of land under irrigation. This acreage has increased steadily from 5,200 acres in 1962 to 7,700 acres in 1970, 15,000 acres in 1978, and about 16,000 acres in 1982. The number of registered irrigation wells rose from 16 in 1962 to 109 in 1982. The Taylor-Ord Canal transports surface irrigation water through Loup County from the North Loup River.

The acreage used for crop production has remained fairly constant. Corn was harvested on 10,330 acres in 1961 and on 10,000 acres in 1981. Of these totals, 3,500 acres was irrigated in 1961 and 9,000 in 1981. Sorghum, wheat, oats, and soybeans also are grown in the county, but the acreage is small. The combined total acreage of these crops was 1,400 acres in 1981. The acreage used for alfalfa has fluctuated from a high of 11,180 acres to a low of 7,400 acres during the 20-year period prior to 1982. In most years alfalfa is harvested on about 10,000 acres. The acreage used for wild hay decreased from 57,180 acres in 1962 to 19,700 acres in 1982.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; and the kinds of crops and native plants growing on the soils. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge

into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data.

The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some soil boundaries and names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in series concepts, different slope groupings, and the application of the latest soil classification system.

Excessively Drained and Moderately Well Drained Soils in the Sandhills

These deep, nearly level to hilly, sandy soils are on uplands and in sandhill valleys. They support native grasses and are used as range. Soil blowing is the main problem. Keeping the range in excellent condition is a management concern.

1. Valentine Association

Deep, rolling and hilly, excessively drained, sandy soils; on uplands

This association consists of soils on dunes in the sandhills. Many of the dunes rise as much as 100 feet or more above the valleys. The dunes are generally oriented in a northwest to southeast direction. The soils formed in sandy eolian material. Slopes range from about 9 to 60 percent.

This association makes up 120,740 acres, or about 33 percent of the county. It is about 99 percent Valentine soils and 1 percent minor soils.

Typically, the surface layer of Valentine soils is grayish brown, loose fine sand about 4 inches thick. The transition layer is light brownish gray, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand.

The minor soils in this association include Ipage, Gates, and Hersh soils. Ipage soils are in swales and are moderately well drained. Gates and Hersh soils have more silt than the Valentine soils. They are well drained. They are in sandhill swales. Blowouts are common throughout this association.

This association supports native grasses used for grazing. A few small areas on the less sloping parts of the landscape are used for hay. The soils are unsuited to cultivated crops because they are too sandy and too steep. The landscape is rolling and hilly, making travel through areas of the association very difficult. Ranching is the main enterprise. It consists mostly of the production of feeder calves and yearlings. Wells can be drilled to provide water for livestock and domestic use.

Soil blowing is a serious hazard on Valentine soils. If the protective grass cover is destroyed, blowouts can form. The rangeland consists mainly of tall and mid prairie grasses. Range management that includes proper grazing use, timely deferment of grazing and haying, and a planned grazing system helps to maintain or improve the range condition.

2. Valentine-Ipage Association

Deep, nearly level to hilly, excessively drained and moderately well drained, sandy soils; on uplands and in sandhill valleys

This association consists of rolling and hilly soils on sandhills and less sloping soils in the intervening

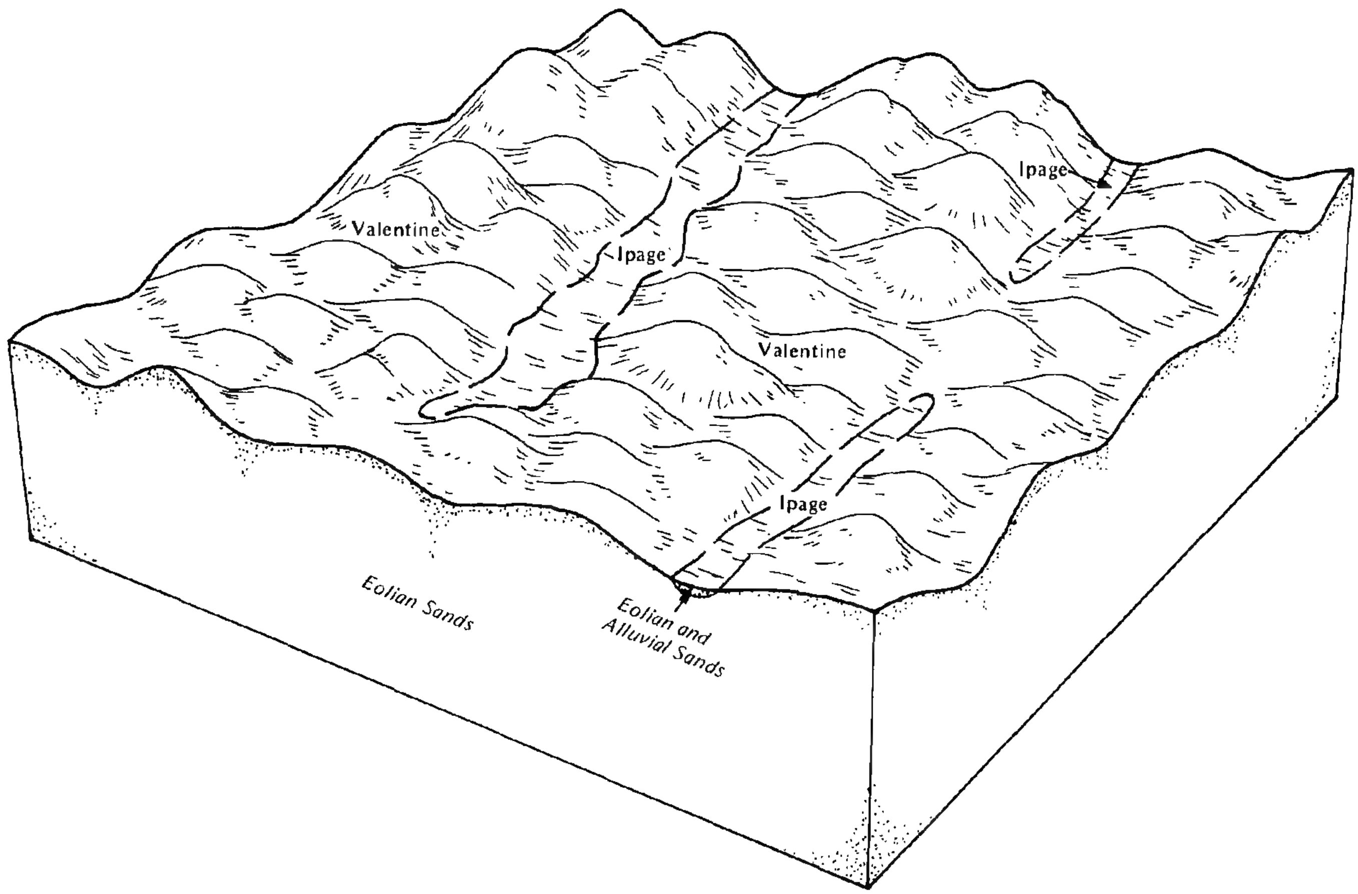

Figure 2.—Typical pattern of soils and parent material in the Valentine-Ipage association.

valleys or swales. The dunes are generally oriented in a northwest to southeast direction. The soils formed in sandy eolian material or sandy alluvium that has been reworked by the wind. Slopes range from 0 to 60 percent.

This association makes up 82,780 acres, or about 23 percent of the county. It is about 87 percent Valentine soils, 8 percent Ipage soils, and 5 percent minor soils (fig. 2).

Valentine soils are gently sloping to hilly. They formed in sandy eolian material. They are excessively drained. Typically, the surface layer is brown, loose fine sand about 5 inches thick. The transition layer is grayish brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand.

Ipage soils are nearly level and very gently sloping. They are in sandhill valleys and swales between areas of Valentine soils. They are moderately well drained. They formed in sandy eolian and alluvial material. Depth to the seasonal high water table ranges from about 3 feet in wet years to about 6 feet in dry years. Typically, the surface layer is grayish brown, very friable fine sand about 5 inches thick. The transition layer is light brownish gray, loose fine sand about 7 inches thick. The underlying material is light gray fine sand to a depth of 60 inches or more. Mottles are below a depth of 34 inches.

The minor soils in this association are Tryon and Els soils. These soils are lower on the landscape than Ipage soils. Tryon soils are poorly drained or very poorly drained, and Els soils are somewhat poorly drained. Small blowouts are common in this association.

Almost all of this association supports native grasses used for grazing. Ranching is the main enterprise. It consists mostly of the production of feeder calves and yearlings. The association is generally unsuited to

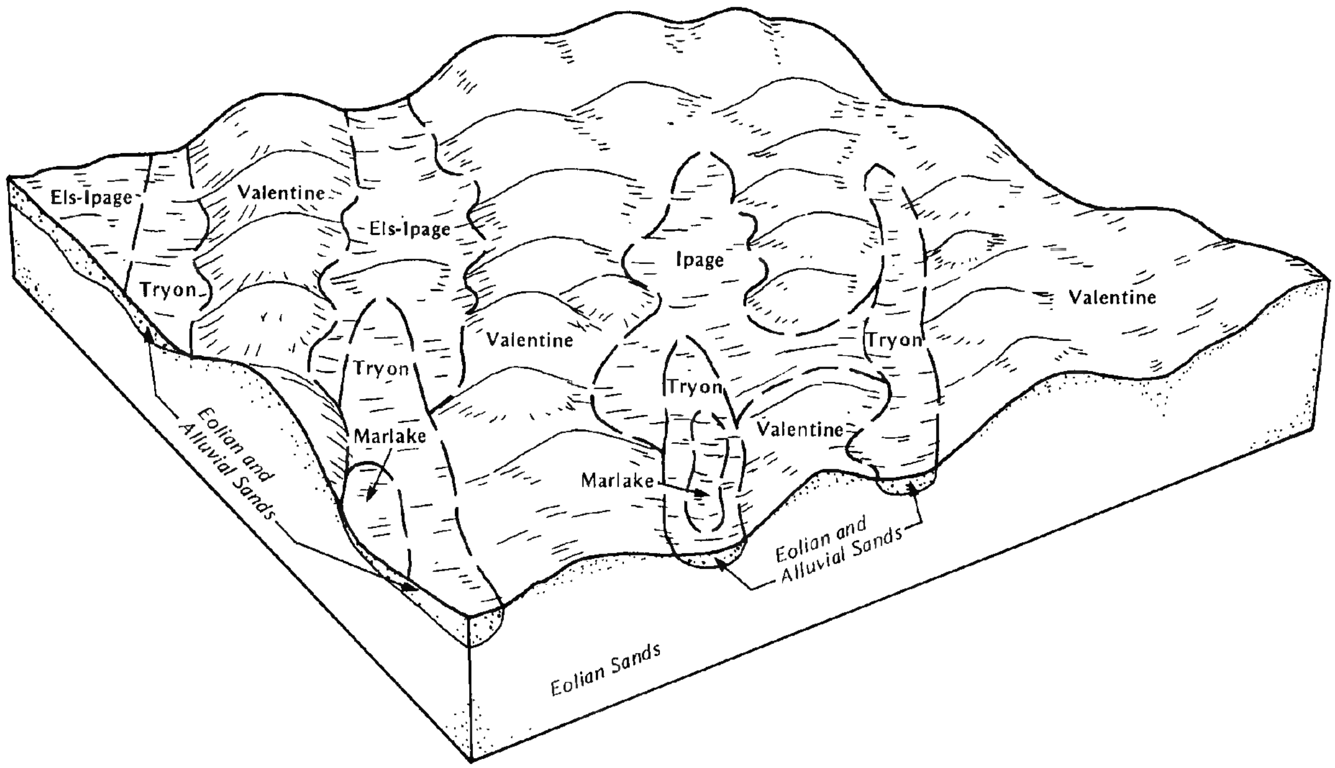

Figure 3.—Typical pattern of soils and parent material in the Valentine-Tryon-Ipage association.

cultivated crops because of the sandy texture of both major soils and the very steep slopes of Valentine soils. Wells can be drilled to provide water for livestock.

The main hazard on the Valentine and Ipage soils is soil blowing. If the protective grass cover is destroyed, blowouts can form. The rangeland consists mainly of tall and mid native grasses. Range management that includes proper grazing use, timely deferment of grazing or haying, and a planned grazing system helps to maintain or improve the range condition.

Excessively Drained, Poorly Drained, Very Poorly Drained, and Moderately Well Drained Soils in the Sandhills

These deep, nearly level to hilly, sandy soils are on uplands and in sandhill valleys. Nearly all of the acreage supports native grasses and is used as range or hayland. Soil blowing is the main problem. Keeping the range in excellent condition is the main management concern.

3. Valentine-Tryon-Ipage Association

Deep, nearly level to hilly, excessively drained, poorly drained, very poorly drained, and moderately well drained, sandy soils; on uplands and in sandhill valleys

This association consists of rolling and hilly soils on sandhills and less sloping soils in the intervening wet valleys. The dunes are generally oriented in a northwest to southeast direction. The soils formed in sandy eolian material or sandy alluvium. Slopes range from 0 to 60 percent.

This association makes up 20,010 acres, or about 5.5 percent of the county. It is about 53 percent Valentine soils, 19 percent Tryon soils, 14 percent Ipage soils, and 14 percent minor soils (fig. 3).

Valentine soils are gently sloping to hilly and are on dunes. They formed in sandy eolian material and are excessively drained. Typically, the surface layer is brown, loose fine sand about 5 inches thick. The transition layer is grayish brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand.

Tryon soils are nearly level and are in sandhill valleys. They formed in sandy eolian and alluvial material. They are poorly drained and very poorly drained. The seasonal high water table ranges from

about 6 inches above the surface in wet years to about 1.5 feet below the surface in dry years. Typically, the surface layer is dark gray, very friable loamy fine sand about 5 inches thick. The transition layer is light gray, very friable fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand.

Ipage soils are nearly level and very gently sloping and are in sandhill valleys. They are moderately well drained. They formed in sandy eolian material. The seasonal high water table ranges from about 3 feet below the surface in wet years to about 6 feet below the surface in dry years. Typically, the surface layer is grayish brown, very friable fine sand about 5 inches thick. The transition layer is light brownish gray, very friable fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand. Mottles are below a depth of 34 inches.

Minor in this association are Marlake and Els soils. Marlake soils are on the lowest part of the landscape and are covered with water for most of the growing season. Els soils are in areas between Ipage and Tryon soils and are somewhat poorly drained. Small blowouts are common throughout the areas of Valentine soils in this association.

Almost all of this association supports native grasses and is used as range or hayland. Ranching is the main enterprise. It consists mostly of the production of feeder calves and yearlings. The association is generally unsuited to cultivated crops because of the very steep slopes of Valentine soils and the wetness of Tryon soils. Wells can be drilled to provide water for livestock.

The main hazard on Valentine and Ipage soils is soil blowing. If the protective grass cover is destroyed, blowouts can form. The rangeland consists mainly of tall and mid native grasses. The seasonal high water table in Tryon soils is beneficial during dry periods, but it is a severe limitation during wet periods. A uniform distribution of grazing is difficult to obtain because of the different growth patterns of plants on the soils in this association. Range management that includes proper grazing use, timely deferment of grazing or haying, and a planned grazing system helps to maintain or improve the range condition.

Moderately Well Drained to Very Poorly Drained Soils in the Sandhills

These deep, nearly level and very gently sloping, sandy soils are in sandhill valleys. They generally suppport native grasses and are used as range or hayland. Some areas are used as cropland. Soil blowing is a hazard. Keeping the range in excellent condition is a management concern.

4. Els-Tryon-Ipage Association

Deep, nearly level and very gently sloping, moderately well drained to very poorly drained, sandy soils; in sandhill valleys

This association consists of soils in broad, wet valleys in the sandhills. Small streams flow through this association. These soils formed in sandy eolian material or in sandy alluvium that has been reworked by the wind. Slopes range from 0 to 3 percent.

This association makes up 5,550 acres, or about 1.5 percent of the county. It is about 41 percent Els soils, 39 percent Tryon soils, 13 percent Ipage soils, and 7 percent minor soils.

Els soils are nearly level and are somewhat poorly drained. They are above Tryon soils and below Ipage soils on the landscape. The seasonal high water table ranges from about 1.5 feet below the surface in wet years to about 3.0 feet below the surface in dry years. Typically, the surface layer is dark grayish brown, very friable loamy sand about 5 inches thick. The transition layer is grayish brown, loose fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand.

Tryon soils are nearly level and are poorly drained or very poorly drained. They are in the lowest positions on the landscape. The seasonal high water table ranges from about 0.5 foot above the surface in wet years to about 1.5 feet below the surface in dry years. Typically, the surface layer is dark gray, very friable loamy fine sand about 5 inches thick. The transition layer is light gray, mottled, very friable fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand.

Ipage soils are nearly level and very gently sloping and are moderately well drained. They are above Els and Tryon soils on the landscape. The seasonal high water table ranges from about 3 feet below the surface in wet years to about 6 feet below the surface in dry years. Typically, the surface layer is grayish brown, very friable fine sand about 5 inches thick. The transition layer is light brownish gray, loose fine sand about 8 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is pale brown in the upper part and light gray and mottled in the lower part.

Minor in this association are Almeria, Marlake, and Valentine soils. Almeria soils are on bottom land along perennial streams and are poorly drained. Valentine

soils are on small dunes and are excessively drained. Marlake soils are in the lowest position on the landscape and are covered with water during most of the growing season.

Most of the acreage in this association supports native grasses harvested for hay. Some areas are cultivated and are irrigated by sprinkler systems. Most irrigated areas are used for alfalfa or tame pasture. The soils are generally too sandy for dryland cultivation. Ranching is the main enterprise. Most of the ranches produce feeder calves and yearlings. Wells can be drilled to provide water for irrigation and livestock.

Soil blowing is a serious hazard if Ipage soils are cultivated. Maintaining crop residue on the surface and applying a system of conservation tillage help to control soil blowing and conserve moisture. Tryon soils are not suitable for cultivation because of the wetness caused by the seasonal high water table. The seasonal high water table in Els soils is beneficial in dry periods, but it can cause wetness problems in spring and during periods of above normal rainfall. In cultivated areas using irrigation water efficiently and maintaining soil fertility are management concerns. In areas used as rangeland, a management system that includes proper grazing use, timely deferment of grazing or haying, and a planned grazing system helps to maintain or improve the range condition.

Excessively Drained to Well Drained, Sandy, Loamy, and Silty Soils on Uplands

These soils are nearly level to very steep. A large acreage is farmed, but most areas support native grasses and are used for grazing or hay. Soil blowing and water erosion are the main problems. Keeping the range in excellent condition, maintaining or improving fertility, and conserving moisture are the main management concerns.

5. Valentine-Hersh-Gates Association

Deep, nearly level to rolling, excessively drained and well drained, sandy, loamy, and silty soils; on uplands

This association consists of gently sloping to rolling, sandy soils on dunes in the sandhills and nearly level to gently sloping, silty and loamy soils, mainly in upland swales. Slopes range from 0 to 24 percent.

This association makes up 69,735 acres, or about 19 percent of the county. It is about 87 percent Valentine soils, 7 percent Hersh soils, 5 percent Gates soils, and 1 percent minor soils.

Valentine soils are gently sloping to rolling and are excessively drained. They formed in sandy eolian material. Typically, the surface layer is grayish brown, very friable fine sand about 5 inches thick. The transition layer is light brownish gray, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand.

Hersh soils are nearly level to gently sloping and are in swales. They are well drained. They formed in loamy and sandy eolian material. Typically, the surface layer is light brownish gray, very friable fine sandy loam about 6 inches thick. The transition layer is light brownish gray, very friable fine sandy loam about 10 inches thick. The upper part of the underlying material is very pale brown loamy very fine sand. The lower part to a depth of 60 inches or more is very pale brown loamy fine sand.

Gates soils are nearly level to gently sloping and are in swales. They are well drained. They formed in loess and reworked loamy material. Typically, the surface layer is grayish brown, very friable silt loam about 6 inches thick. The transition layer is light brownish gray, very friable silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown silt loam. Lime is at a depth of about 21 inches.

Minor in this association are Ipage soils. These soils are in swales between areas of Valentine soils. They are moderately well drained. Also of minor extent are small areas of steep or very steep side slopes along drainageways and a few small areas of steep sand dunes.

Most of this association supports native grasses used for grazing. Some areas of Valentine soils are mowed for hay. A large acreage of Hersh and Gates soils is cultivated. Alfalfa and corn are the main crops. A few areas are irrigated. Ranching is the main enterprise, and most crops are grown as feed for livestock. The few farms in areas of this association are a combination of livestock and cash-grain enterprises. Wells can generally be drilled to provide water for livestock and irrigation.

Soil blowing is the main hazard in cultivated areas. Low rainfall is a limitation under dryland management. Maintaining crop residue on the surface and applying a system of conservation tillage help to control soil blowing and conserve moisture. Using irrigation water efficiently and maintaining fertility are management concerns in irrigated areas. Range management that includes proper grazing use, timely deferment of grazing or haying, and a planned grazing system helps to maintain or improve the range condition.

6. Hersh-Gates-Valentine Association

Deep, nearly level to very steep, excessively drained to

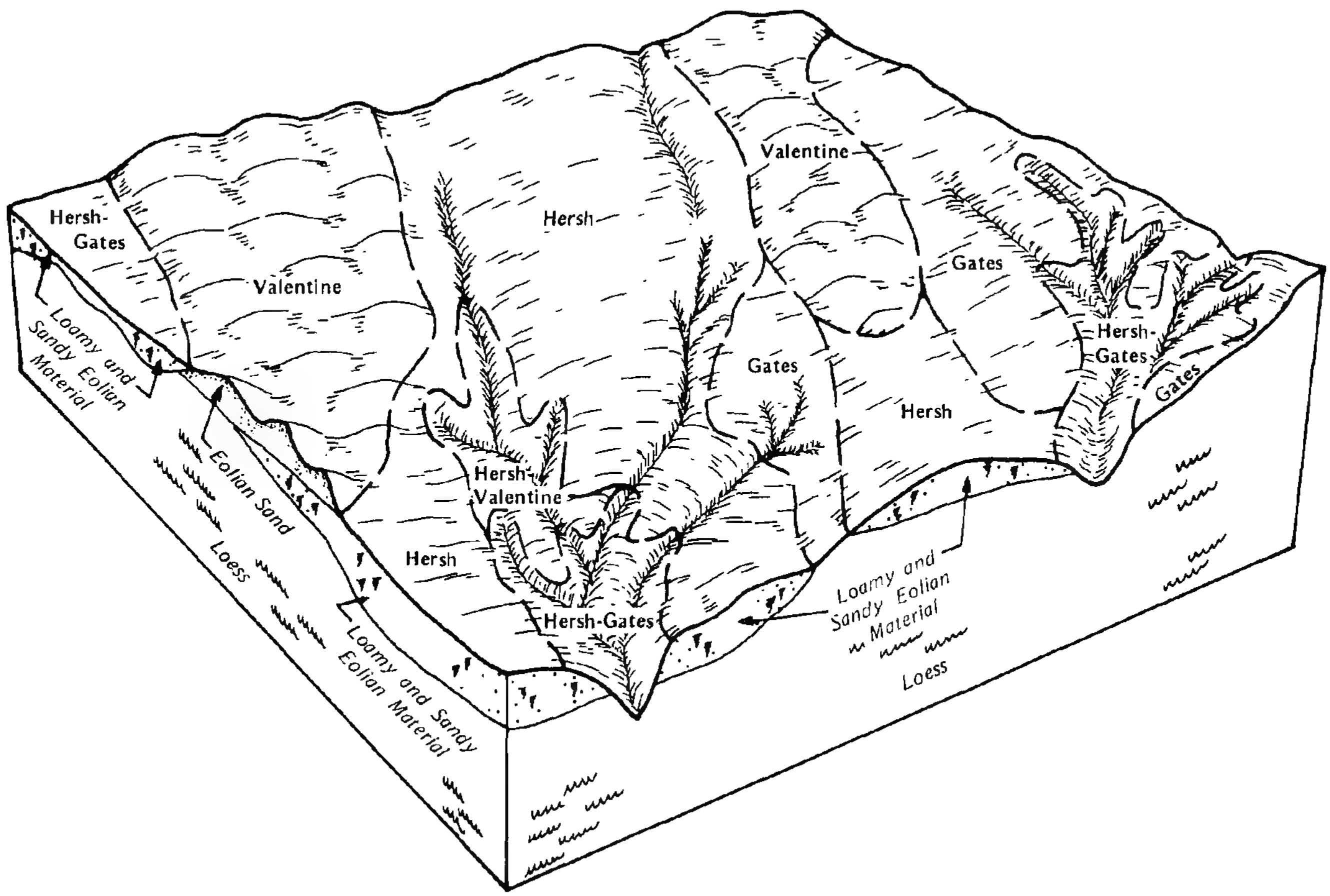

Figure 4.—Typical pattern of soils and parent material in the Hersh-Gates-Valentine association.

well drained, loamy, silty, and sandy soils; on uplands

This association consists mainly of soils on uplands, on side slopes, and along drainageways. Some areas are hummocky. Slopes range from 0 to 60 percent.

This association makes up 20,570 acres, or about 6 percent of the county. It is about 38 percent Hersh soils, 30 percent Gates soils, 24 percent Valentine soils, and 8 percent minor soils (fig. 4).

Hersh soils are nearly level to very steep and are on uplands, on side slopes along drainageways, and in swales. Some areas are hummocky. These soils are well drained to excessively drained. They formed in mixed loamy and sandy eolian material. Typically, the surface layer is light brownish gray, very friable fine sandy loam about 6 inches thick. The transition layer also is light brownish gray, very friable fine sandy loam. It is about 10 inches thick. The underlying material to a depth of 60 inches or more is very pale brown. It is loamy very fine sand in the upper part and loamy fine sand in the lower part.

Gates soils are nearly level to very steep and are on uplands, on side slopes along intermittent drainageways, and in swales. They are well drained to excessively drained. They formed in loess and reworked loamy material. Typically, the surface layer is grayish brown, very friable silt loam about 6 inches thick. The transition layer is light brownish gray, very friable silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown silt loam. Lime is at a depth of about 21 inches.

Valentine soils are gently sloping to rolling and are on uplands. Some areas are hummocky. These soils are excessively drained. They formed in sandy eolian material. Typically, the surface layer is grayish brown, very friable fine sand about 5 inches thick. The transition layer is light brownish gray, loose fine sand

about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand.

Minor in this association are Cozad, Coly, Hobbs, and Uly soils. Cozad and Hobbs soils are on silty bottom land and stream terraces along drainageways. Hobbs soils are stratified. Coly soils are on very steep side slopes along drainageways. They have carbonates at the surface. Uly soils have a surface layer that is thicker and darker colored than that of Gates soils. They are on strongly sloping to moderately steep side slopes.

About half of this association is farmed. Some areas are irrigated by sprinklers. The remaining areas support native grasses and are used as range or hayland. A large acreage is used for dryland crops, mainly corn, sorghum, and alfalfa. Corn and alfalfa are the main irrigated crops. Farms in areas of this association are generally a combination of livestock and cash-grain enterprises. Wells can generally be drilled to provide water for livestock and irrigation.

Soil blowing and water erosion are the main hazards in cultivated areas. Low rainfall is a limitation affecting dryland cultivation. Maintaining crop residue on the surface and applying a system of conservation tillage help to control soil blowing and water erosion and conserve moisture. If the soils are irrigated, using water efficiently and maintaining fertility are management concerns. Range management that includes proper grazing use, timely deferment of grazing or haying, and a planned grazing system helps to maintain or improve the range condition.

Excessively Drained and Well Drained, Silty Soils on Dissected Uplands and Bottom Land

These soils are deep and are very gently sloping to very steep. Most of the acreage supports native grasses and is used for grazing. A few small areas are farmed. Water erosion and soil blowing are the main problems. Keeping the range in excellent condition is the main management concern.

7. Coly-Uly-Hobbs Association

Deep, very gently sloping to very steep, excessively drained and well drained, silty soils; on uplands and bottom land

This association consists of soils on deeply dissected uplands and narrow bottom land. The landscape is one of very narrow ridgetops, irregular side slopes, and intermittent drainageways. Slopes range from about 2 to 60 percent.

This association makes up 5,330 acres, or about 1.5 percent of the county. It is about 53 percent Coly soils, 19 percent Uly soils, 17 percent Hobbs soils, and 11 percent minor soils.

Coly soils are steep and very steep and are on side slopes and canyon sides. They are excessively drained. They formed in loess. Typically, the surface layer is very friable, calcareous silt loam about 5 inches thick. The transition layer is light brownish gray, very friable, calcareous silt loam about 5 inches thick. The underlying material to a depth of 60 inches or more is very pale brown and calcareous. It is silt loam in the upper part and very fine sandy loam in the lower part.

Uly soils are strongly sloping and moderately steep and are on side slopes and ridgetops. They are well drained. They formed in loess. Typically, the surface layer is dark grayish brown, very friable silt loam about 12 inches thick. The subsoil is very friable silt loam about 22 inches thick. It is grayish brown in the upper part and light brownish gray in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Hobbs soils are very gently sloping and are on bottom land along narrow intermittent drainageways. They are well drained. They formed in alluvium and are occasionally flooded. Typically, the surface layer is grayish brown, very friable silt loam about 6 inches thick. The underlying material to a depth of 60 inches or more is stratified silt loam. It is dark grayish brown and light brownish gray in the upper part and pale brown and very pale brown in the lower part. Strata of very fine sandy loam, loam, and fine sandy loam are in the underlying material.

Minor in this association are Gates and Hersh soils on side slopes and ridgetops. Hersh soils contain more sand than the major soils. Gates soils are deeper to lime than Coly soils. They are on the gentler slopes. Also of minor extent are vertical escarpments of unweathered loess.

The soils in this association generally support native grasses used for grazing. Some areas are covered with trees, shrubs, and forbs. The association is generally unsuited to cultivated crops because of the steep and very steep slopes. A few of the gentler slopes and the more accessible areas on bottom land are used for dryland crops. Alfalfa is the main cultivated crop. Some areas that were cultivated in the past are now seeded to native grasses. Ranching is the main enterprise in areas of this association. Most of the ranches produce feeder calves and yearlings. A few landowners fatten cattle in feedlots. Water for livestock and domestic use is drawn from wells.

Water erosion is the major hazard on side slopes in

this association, and flooding is a hazard on bottom land. Proper grazing use, timely deferment of grazing, and a planned grazing system help to improve or maintain the range condition. A uniform distribution of grazing is difficult to achieve because of the steep and very steep slopes. Proper placement of fences and water and salting facilities can improve the distribution of livestock and achieve a more uniform grazing pattern.

Excessively Drained, Well Drained, Moderately Well Drained, and Somewhat Poorly Drained, Silty and Sandy Soils on Stream Terraces and Uplands

These soils are deep and are nearly level to strongly sloping. Most of the silty soils are farmed, and a large acreage of them is irrigated. Most of the sandy soils support native grasses, although a small acreage is used for irrigated crops. Soil blowing is the main hazard. Using irrigation water efficiently, maintaining fertility, and keeping the range in excellent condition are the main management concerns.

8. Cozad-Hord Association

Deep, nearly level and very gently sloping, well drained, silty soils; on stream terraces

This association consists of soils on terraces adjacent to the major streams. These soils are subject to rare flooding. They formed in loess and alluvium. Slopes range from 0 to 3 percent.

This association makes up 6,475 acres, or about 2 percent of the county. It is about 38 percent Cozad soils, 37 percent Hord soils, and 25 percent minor soils.

Cozad soils are nearly level and very gently sloping and are well drained. They formed in alluvium. Typically, the surface layer is grayish brown, very friable silt loam about 12 inches thick. The subsoil is very friable silt loam about 14 inches thick. It is light. brownish gray in the upper part and light gray and calcareous in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Hord soils are nearly level and well drained. They formed in mixed loess and alluvium. Typically, the surface layer is dark grayish brown and very dark gray, very friable silt loam about 18 inches thick. The subsoil is dark grayish brown and grayish brown, very friable silt loam about 20 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous silt loam.

Minor in this association are Hobbs, Uly, Ipage, Vetal, and Hersh soils. Hobbs soils are on bottom land along narrow, entrenched drainageways and are commonly flooded. Uly soils are on strongly sloping and moderately steep side slopes and are well drained. Ipage soils are sandy. They are moderately well drained and are on the lower parts of the landscape. Vetal soils have a thick, dark colored surface soil and contain more sand than the major soils. The only area of Vetal soils in Loup County is on a stream terrace along the Middle Loup River, at the Loup-Blaine county line. These are the dominant soils in the area of this association along the county line. Hersh soils are in the slightly higher positions on the landscape. They have a light colored surface layer and contain more sand than the major soils.

Most areas of this association are used for irrigated crops. The remaining acreage is used for dryland farming or supports native grasses used for grazing or hay. Gravity irrigation systems are used extensively. Water for irrigation is drawn mostly from canals, but in many areas it is drawn from deep wells. Corn and alfalfa are the main irrigated crops. Corn, alfalfa, and sorghum are the main dryland crops. Farms in areas of this association are either cash-grain enterprises or a combination of cash-grain and livestock enterprises. Some landowners fatten cattle for market in feedlots. Wells can be readily drilled to provide water for irrigation and livestock.

The efficient use of irrigation water is the main management concern. Low rainfall is a limitation affecting dryland cultivation. Maintaining fertility can be a problem where deep cuts are made in land-leveling operations. Conserving soil moisture also is a management concern. Conservation tillage helps to conserve moisture. Proper grazing use, timely deferment of grazing, and a planned grazing system help to maintain or improve the range condition.

9. Ipage-Valentine-Elsmere Association

Deep, nearly level to strongly sloping, excessively drained, moderately well drained, and somewhat poorly drained, sandy soils; on stream terraces and uplands

This association consists of soils formed in alluvium and sandy eolian material on stream terraces and uplands along the North Loup and Calamus Rivers. Slopes range from 0 to 9 percent.

This association makes up 11,790 acres, or about 3.3 percent of the county. It is about 61 percent Ipage soils on terraces, 12 percent Valentine soils, 10 percent Elsmere soils, and 17 percent minor soils (fig. 5).

Ipage soils are nearly level and very gently sloping and are moderately well drained. They formed in sandy

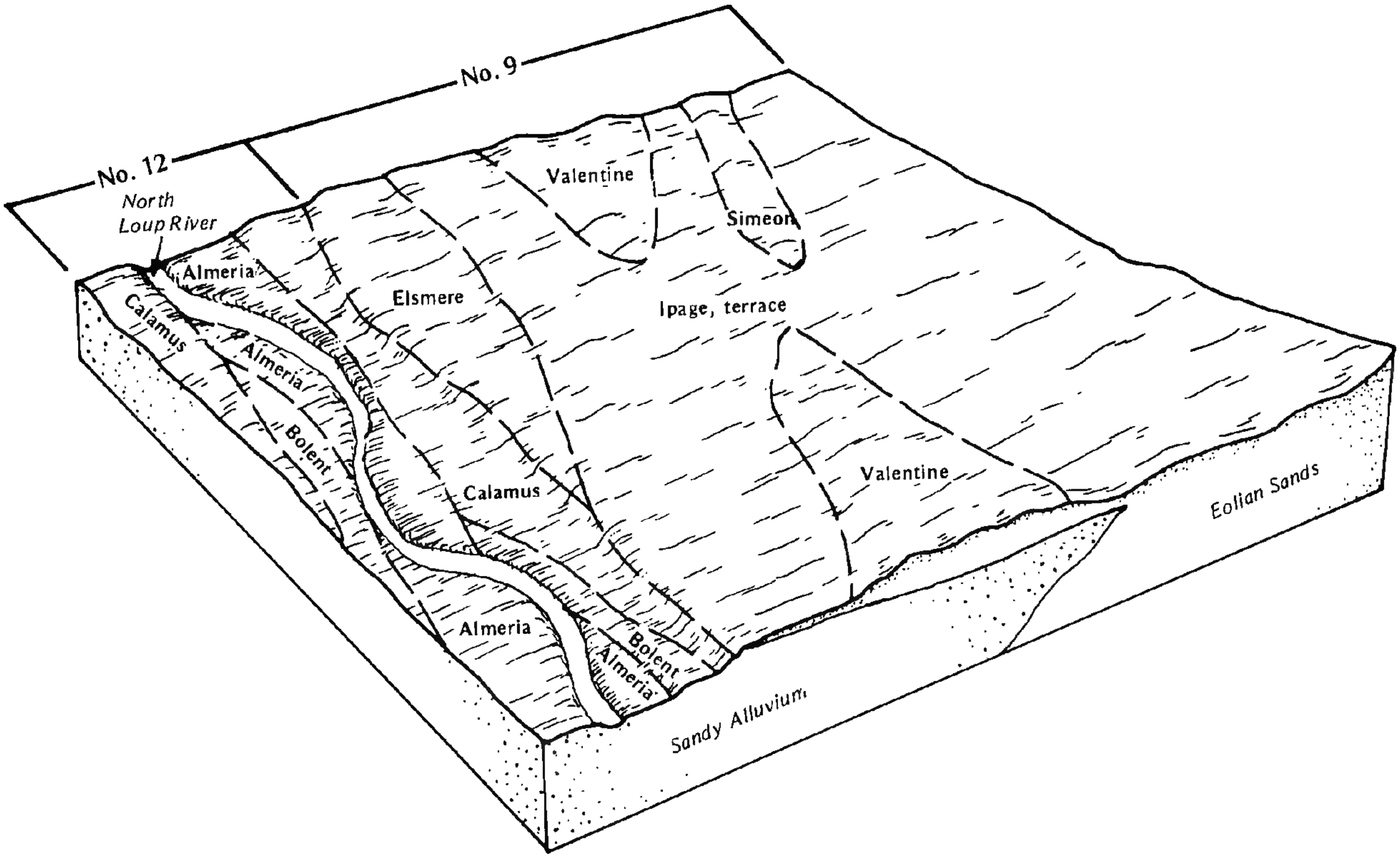

Figure 5.—Typical pattern of soils and parent material in the Ipage-Valentine-Elsmere and Almeria-Calamus-Bolent associations.

eolian and alluvial material on stream terraces. Depth to the seasonal high water table ranges from about 3.5 feet in wet years to about 6.0 feet in dry years. Typically, the surface layer is dark grayish brown, loose fine sand or loamy fine sand about 8 inches thick. The transition layer is brown, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is fine sand and sand. It is pale brown in the upper part and white in the lower part. Mottles are below a depth of 34 inches.

Valentine soils are very gently sloping to strongly sloping and are excessively drained. They formed in sandy eolian material on uplands. Typically, the surface layer is grayish brown, very friable loamy fine sand or fine sand about 7 inches thick. The transition layer is pale brown, very friable loamy fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand.

Elsmere soils are nearly level and somewhat poorly drained. They are slightly lower on the landscape than Ipage soils. They formed in sandy alluvial material on stream terraces. Depth to the seasonal high water table ranges from about 1.5 feet in wet years to about 3.0 feet in dry years. Typically, the surface layer is grayish brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is grayish brown and dark grayish brown, very friable loamy fine sand about 8 inches thick. The underlying material to a depth of 60 inches or more is light gray and mottled. It is very fine sandy loam in the upper 6 inches and fine sand in the lower part.

Minor in this association are Els, Hersh, Boelus, and Simeon soils. Els soils are in landscape positions similar to those of Elsmere soils. They have a surface soil that is thinner than that of Elsmere soils. Hersh soils are well drained and are higher on the landscape than Ipage soils. Also, they contain less sand. Boelus soils are loamy in the lower part of the subsoil. Simeon

soils are coarser textured than Valentine soils. Boelus and Simeon soils are higher on the landscape than Ipage soils.

Most of the acreage in this association supports native grasses and is used for range. A large acreage of the Elsmere and Ipage soils is used for cultivated crops, and most areas of these soils are irrigated by center-pivot sprinkler systems. Ranching is the main enterprise. Farms in areas of this association are a combination of livestock and cash-grain enterprises. The main irrigated crops are corn and alfalfa. The main dryland crop is alfalfa. Water for irrigation and livestock is drawn from wells.

Soil blowing is a hazard in this association. Insufficient rainfall during the growing season is the main limitation. Controlling soil blowing and managing irrigation water are concerns in irrigated areas. The seasonal high water table in Elsmere soils can be a problem in wet years. A conservation tillage system helps to control soil blowing and conserves moisture. Measures that maintain or improve fertility are needed. Range management that includes proper grazing use, timely deferment of grazing or haying, and a planned grazing system helps to maintain or improve the range condition.

10. Valentine-Simeon-Boelus Association

Deep, nearly level to strongly sloping, excessively drained and well drained, sandy soils; on uplands and stream terraces

This association consists of nearly level to strongly sloping Valentine soils on uplands and nearly level and very gently sloping Simeon and Boelus soils on broad stream terraces. The soils formed in sandy eolian material and sandy and loamy alluvium. Slopes range from 0 to 9 percent.

This association makes up 8,760 acres, or about 2.5 percent of the county. It is about 40 percent Valentine soils, 32 percent Simeon soils, 15 percent Boelus soils, and 13 percent minor soils.

Valentine soils are on small dunes. They are excessively drained. They formed in sandy eolian material. Typically, the surface layer is grayish brown, loose fine sand or loamy fine sand about 6 inches thick. The transition layer is pale brown, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand.

Simeon soils are excessively drained. They formed in sandy alluvium. Typically, the surface layer is grayish brown, very friable sand about 6 inches thick. The transition layer is brown, loose sand about 4 inches thick. The underlying material extends to a depth of 60 inches or more. It is pale brown sand in the upper part, very pale brown sand in the next part, and white, stratified sand and coarse sand in the lower part.

Boelus soils are in areas between Valentine and Simeon soils. They are well drained. They formed in sandy eolian material deposited over loamy alluvium. Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 6 inches thick. The subsurface layer is grayish brown, very friable loamy fine sand about 8 inches thick. The subsoil is about 27 inches thick. The upper part is pale brown, loose fine sand; the next part is brown, friable loam; and the lower part is brown and light brownish gray, very friable sandy loam. The underlying material to a depth of 60 inches or more is light gray sand.

Minor in this association are the moderately well drained Ipage soils on the lower parts of the landscape.

The soils in this association generally support native grasses and are used as range. Ranching is the main enterprise. A few areas of cropland are irrigated by sprinkler systems. The soils are too droughty for dryland farming. A sprinkler system is the best method of irrigation. The main irrigated crops are alfalfa and corn. Water for irrigation and livestock is drawn from deep wells.

Soil blowing is a severe hazard in this association. Controlling soil blowing and using irrigation water efficiently are management concerns in irrigated areas. A conservation tillage system helps to control soil blowing and conserves moisture. Measures that maintain or improve fertility are needed. Range management that includes proper grazing use, timely deferment of grazing, and a planned grazing system helps to maintain or improve the range condition.

Moderately Well Drained to Very Poorly Drained, Loamy and Sandy Soils on Bottom Land

These soils are nearly level. A large acreage is farmed, but most areas support native grasses and are used as range or hayland. The main hazards are soil blowing and flooding. The main management concerns are keeping the range in excellent condition and maintaining high fertility in cultivated areas.

11. Ord-Bolent-Almeria Association

Deep, nearly level, somewhat poorly drained to very poorly drained, loamy and sandy soils; on bottom land

This association consists of soils formed in alluvium on bottom land along the North Loup River. Slopes range from 0 to 2 percent.

This association makes up 5,780 acres, or about 1.6 percent of the county. It is about 32 percent Ord soils, 17 percent Bolent soils, 15 percent Almeria soils, and 36 percent minor soils.

Ord soils are somewhat poorly drained. They are subject to rare flooding. Depth to the seasonal high water table ranges from 1.5 feet in wet years to about 3.5 feet in dry years. Typically, the surface layer is grayish brown, very friable, calcareous very fine sandy loam about 5 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 5 inches thick. The transition layer is light gray, very friable, calcareous very fine sandy loam about 5 inches thick. The underlying material extends to a depth of 60 inches or more. It is light gray. The upper part is mottled, calcareous fine sandy loam that has strata of fine sandy loam. The next part is mottled loamy fine sand that has strata of very fine sandy loam and fine sandy loam. The lower part is fine sand that has strata of loamy fine sand.

Bolent soils are somewhat poorly drained. These soils are occasionally flooded. Depth to the seasonal high water table ranges from about 1.5 feet in wet years to about 3.5 feet in dry years. Typically, the surface layer is dark grayish brown, calcareous, very friable loamy fine sand about 6 inches thick. The underlying material extends to a depth of 60 inches or more. It is mottled. It is light brownish gray and dark grayish brown, stratified sand, loamy fine sand, and fine sandy loam in the upper part and light gray and white, stratified coarse sand, sand, and loamy very fine sand in the lower part.

Almeria soils are poorly drained or very poorly drained. They are on the lower parts of the landscape. They are occasionally or frequently flooded. The seasonal high water table ranges from about 0.5 foot above the surface in wet years to about 1.5 feet below the surface in dry years. Typically, the surface layer is dark gray, very friable, calcareous loamy fine sand about 5 inches thick. The underlying material extends to a depth of 60 inches or more. It is mottled in the upper part. In sequence downward, it is light gray sand; stratified light brownish gray fine sand and grayish brown loamy very fine sand; very dark gray fine sandy loam; stratified dark gray fine sandy loam and light gray fine sand; and gray fine sand.

Minor in this association are Ipage, Calamus, and Loup soils and Fluvaquents. Calamus and Ipage soils are higher on the landscape than Bolent soils and are moderately well drained. Loup soils are in landscape positions similar to those of Almeria soils. Their dark colored surface layer is thicker than that of Almeria soils. Fluvaquents are in the lowest positions on the bottom land and are covered by water for most of the growing season.

Most of the acreage in this association supports native grasses and is used as range or hayland. Some areas have dense stands of trees and shrubs and are best suited to wildlife habitat. Some of the higher areas on bottom land are used for dryland or irrigated crops. Irrigation water is drawn mainly from wells, but some is pumped from the North Loup River. Corn and alfalfa are the main crops. Farming is the main enterprise in areas of this association, and most farms are a combination of livestock and cash-grain enterprises.

The seasonal high water table and the flooding are the main management concerns on bottom land. Because of the wetness, the soils warm up slowly in spring and planting and harvesting are delayed in some years. Some areas are dissected by shallow drainage channels that stay wetter than the surrounding soils and make the areas difficult to work. In the areas of native grass, the seasonal high water table can delay or prevent haying in wet years. Range management that includes proper grazing use, timely deferment of grazing or haying, and a planned grazing system helps to maintain or improve the range condition.

12. Almeria-Calamus-Bolent Association

Deep, nearly level, moderately well drained to very poorly drained, sandy soils; on bottom land

This association consists of soils on bottom land along the North Loup and Calamus Rivers. These soils formed in sandy alluvium. Slopes range from 0 to 2 percent.

This association makes up 3,930 acres, or about 1.1 percent of the county. It is about 37 percent Almeria soils, 31 percent Calamus soils, 13 percent Bolent soils, and 19 percent minor soils (fig. 5).

Almeria soils are poorly drained and very poorly drained. They are occasionally or frequently flooded. The seasonal high water table ranges from about 0.5 foot above the surface in wet years to about 1.5 feet below the surface in dry years. Typically, the surface layer is dark gray, very friable, calcareous loamy fine sand about 5 inches thick. The underlying material extends to a depth of 60 inches or more. In sequence downward, it is light gray sand; stratified light brownish gray fine sand and grayish brown loamy very fine sand; very dark gray fine sandy loam; stratified dark gray fine sandy loam and light gray fine sand; and gray fine sand. Mottles are at a depth of about 5 inches.

Calamus soils are moderately well drained. They are

subject to rare flooding. Depth to the seasonal high water table ranges from about 3 feet in wet years to about 6 feet in most dry years. Typically, the surface layer is grayish brown, very friable loamy fine sand about 5 inches thick. The transition layer is light brownish gray, loose fine sand about 9 inches thick. The underlying material to a depth of 60 inches or more is light gray, stratified sand, coarse sand, and gravelly coarse sand.

Bolent soils are somewhat poorly drained. They are occasionally flooded. Depth to the seasonal high water table ranges from about 1.5 feet in wet years to about 3.5 feet in dry years. Typically, the surface layer is dark grayish brown, calcareous, very friable loamy fine sand about 6 inches thick. The underlying material extends to a depth of 60 inches or more. It is light brownish gray and dark grayish brown, stratified sand, loamy fine sand, and fine sandy loam in the upper part and light gray and white, stratified coarse sand, sand, and loamy very fine sand in the lower part. Mottles are below a depth of about 19 inches.

Minor in this association are Ipage soils and small areas of Fluvaquents. Ipage soils are on stream terraces and are higher on the landscape than Calamus soils. They are not stratified. Fluvaquents are in the lowest positions on bottom land. They are frequently flooded and are covered by water for most of the growing season.

Most of this association supports native grasses and is used as range or hayland. A few small areas are used as cropland irrigated by sprinkler systems. Corn and alfalfa are the main crops. Some areas are covered with trees, shrubs, and forbs. These areas are used as habitat for wildlife or provide limited grazing for livestock. Ranching is the main enterprise in areas of this association. Water for livestock or irrigation is drawn from wells.

The seasonal high water table is the main limitation, and the flooding is a hazard. The water table can delay haying in wet years. Some areas are dissected by shallow channels that stay wet longer than the surrounding slopes. Operating equipment is difficult in these areas. Soil blowing is a severe hazard unless the surface of Calamus soils is protected. Range management that includes proper grazing use, timely deferment of grazing or haying, and a planned grazing system helps to maintain or improve the range condition.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Gates silt loam, 1 to 3 percent slopes, is a phase of the Gates series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Tryon-Ipage complex, 0 to 3 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The map unit Pits and dumps is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties published at an earlier date. Differences are the result of changes and refinements in series concepts, different slope groupings, and the application of the latest soil classification system.

Soil mapping was completed prior to construction of the Calamus Dam. Soil maps show conditions as they existed in 1985, before the reservoir was filled.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Ab—Almeria loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, poorly drained soil formed in sandy alluvium on bottom land along streams and rivers in the sandhills. It is occasionally flooded. Areas generally are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark gray, very friable, calcareous loamy fine sand about 5 inches thick. The underlying material extends to a depth of 60 inches or more. In sequence downward, it is light gray, mottled

Figure 6.—A native hay meadow in an area of Almeria loamy fine sand, 0 to 2 percent slopes.

sand; stratified light brownish gray and grayish brown, mottled fine sand and loamy very fine sand; very dark gray fine sandy loam; and stratified dark gray, gray, and light gray fine sandy loam and fine sand. In places the dark surface layer is more than 10 inches thick. In some years some of the low areas and drainageways are covered with water for a few days in spring and during other wet periods.

Included with this soil in mapping are small areas of Bolent and Calamus soils and small areas of Fluvaquents. Bolent and Calamus soils are higher on the landscape than the Almeria soil and are better drained. Fluvaquents are in the lower areas and are covered by water during most of the growing season. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Almeria soil, and the available water capacity is low. The organic matter content is moderately low. Runoff is very slow. The seasonal high water table is at the surface in wet years and is within a depth of about 1.5 feet in dry years. The water table normally drops to a depth of about 2 to 4 feet in late summer.

Nearly all of the acreage supports native grasses and is used as range or hayland (fig. 6). This soil is too wet for use as cropland. It is best suited to range or native hay. The climax vegetation is dominantly big bluestem, prairie cordgrass, switchgrass, and sedges. These species make up 75 percent or more of the total annual forage. Reedgrass, rushes, and other perennial grasses make up the rest. In some areas introduced grasses, such as creeping foxtail, are also part of the plant community. If the range is subject to continuous heavy grazing or if it is improperly harvested for hay, big bluestem, prairie cordgrass, and switchgrass decrease

in abundance and are replaced by slender wheatgrass, western wheatgrass, plains muhly, and sedges. Timothy, redtop, and clover also increase if they are overseeded. If overgrazing or improper haying continues for many years, bluegrass, western wheatgrass, foxtail barley, sedges, rushes, and forbs dominate the site. When the surface is wet, overgrazing and the use of heavy machinery cause surface compaction and the formation of small mounds and ruts, which hinder grazing and haying.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods helps to maintain or improve the range condition. This soil generally is the first to be overgrazed when it is grazed in conjunction with better drained, sandy soils. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

In areas used as hayland, regulating mowing helps to keep the grasses vigorous. Large meadows can be divided into three sections to be mowed in rotation. Changing the order in which the sections are mowed in successive years helps to keep the hayland in good condition. After the ground is frozen, livestock can graze without damaging the meadows. Removing the livestock in spring, before frost leaves the soil and the water table reaches a high level, also helps to keep the hayland in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The only suitable species are those that can withstand a high water table. In some areas site preparation and planting are not possible until the water table drops and the soil is sufficiently dry. The weeds and undesirable grasses that compete with the trees and shrubs can be controlled by cultivating between the tree rows when the water table is at its lowest level.

This soil is not suitable as a site for sanitary facilities or dwellings because of the flooding and the wetness. A suitable alternative site is needed. The sides of shallow excavations can cave in unless they are temporarily shored. Constructing roads on suitable, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the road damage caused by flooding and wetness.

The land capability unit is Vw-7, dryland; Wet Subirrigated range site; windbreak suitability group 2D.

Ac—Almeria loamy fine sand, wet, 0 to 2 percent slopes. This deep, nearly level, very poorly drained soil formed in sandy alluvium on bottom land along streams and rivers in the sandhills. It is occasionally flooded and is commonly ponded by water from the seasonal high water table in spring and in other wet periods. Areas range from 5 to 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 4 inches thick. The underlying material extends to a depth of 60 inches or more. It is stratified dark gray and light brownish gray fine sand, loamy fine sand, and fine sandy loam in the upper part and stratified light brownish gray and white sand and fine sand in the lower part. It has mottles in the upper part. In some areas the surface layer is fine sand or fine sandy loam. In places the dark surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of Bolent and Calamus soils and small areas of Fluvaquents. Bolent and Calamus soils are higher on the landscape than the Almeria soil and are better drained. Fluvaquents are in the lower areas and are covered by water during most of the growing season. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Almeria soil, and the available water capacity is low. The content of organic matter is moderately low. Runoff is very slow or ponded. The seasonal high water table ranges from 0.5 foot above the surface in wet years to about 1.0 foot below the surface in dry years. The water table drops to a depth of about 1 to 2 feet in late summer.

Most of the acreage supports native grasses and is used as range or hayland. This soil is not suited to crops because it is too wet.

In areas used as rangeland, the climax vegetation is dominated by prairie cordgrass, bluejoint reedgrass, northern reedgrass, and rushes. These species make up 70 percent or more of the total annual forage. Slender wheatgrass, sedges, and forbs make up the rest. In some areas introduced grasses, such as reed canarygrass and creeping foxtail, are also part of the plant community. If the range is subject to continuous heavy grazing, prairie cordgrass, bluejoint reedgrass, northern reedgrass, and reed canarygrass decrease in abundance and are replaced by slender wheatgrass, plains bluegrass, green muhly, sedges, rushes, and forbs. If overgrazing continues for many years, bluegrass, foxtail barley, sedges, rushes, and forbs dominate the site. When the surface is wet, overgrazing and the use of heavy machinery cause surface compaction and the formation of mounds and ruts, which make grazing or harvesting for hay difficult.

In most areas the range is in good condition. The suggested initial stocking rate is about 1.5 animal unit months per acre. This soil is used for grazing mostly in

the fall and winter. It produces a high quantity of low-quality forage. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods helps to maintain or improve the range condition.

In areas used as hayland, regulating mowing helps to keep the grasses healthy and vigorous. In some years hay cannot be harvested in some wet areas. After the ground is frozen, livestock can graze without damaging the meadow. Removing the livestock in spring, before the ground thaws and the water table reaches a high level, helps to keep the hayland in good condition.

This soil is generally unsuited to the trees and shrubs grown as windbreaks because of the wetness caused by the high water table. A few areas can be used for the trees or shrubs that enhance recreation areas or wildlife habitat or for forestation plantings if suitable species are hand planted or other special management is applied.

This soil is not suited to use as a site for sanitary facilities or dwellings because of the ponding and the flooding. A suitable alternative site is needed. The sides of shallow excavations can cave in unless they are shored. The shoring should be done during a dry period. Constructing roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater and wetness.

The land capability unit is Vw-7, dryland; Wetland range site; windbreak suitability group 10.

Ad—Almeria fine sandy loam, channeled. This deep, nearly level, very poorly drained soil formed in sandy alluvium. It is on bottom land that is frequently flooded. Areas range from 5 to 100 acres in size.

Typically, the surface layer is dark gray, very friable fine sandy loam about 4 inches thick. The underlying material extends to a depth of 60 inches or more. The upper part is light gray, mottled loamy sand and sand stratified with dark gray loam. The lower part is light gray and white, stratified sand and coarse sand. In some areas the surface layer is loam or loamy fine sand. In places the dark surface soil is more than 7 inches thick.

Included with this soil in mapping are small areas of Bolent, Calamus, and Loup soils and small areas of Fluvaquents. Bolent and Calamus soils are higher on the landscape than the Almeria soil and are better drained. Loup soils are slightly higher on the landscape than the Almeria soil. Also, they have a thicker surface soil. Fluvaquents are lower on the landscape than the Almeria soil and are covered by water during most of the growing season. Also included are a few areas where about 4 to 15 inches of black, undecomposed organic material is on the surface and areas where water stands in some of the shallow drainageways and channels most of the year. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Almeria soil, and the available water capacity is low. The content of organic matter is moderately low. Runoff is very slow or ponded. The seasonal high water table ranges from 0.5 foot above the surface in wet years to about 1.0 foot below the surface in dry years.

Most of the acreage supports native vegetation and is used for limited grazing. This soil is not suited to cropland because of wetness.

Trees, shrubs, and grasses are the dominant plants in areas of this soil. The chief plants are cottonwood, willow, redosier dogwood, and indigobush. The soil is best suited to the development of habitat for wildlife (fig. 7). The grasses are dominantly prairie cordgrass, bluejoint reedgrass, northern reedgrass, sedges, rushes, and weeds. Grazing when the soil is wet results in the formation of small mounds, which make grazing difficult.

This soil is generally not suited to the trees and shrubs grown as windbreaks. Some areas can be used for the water-tolerant trees and shrubs that enhance wildlife habitat or recreation areas if suitable species are planted by hand or other special management is applied.

This soil is not suitable as a site for sanitary facilities or dwellings because of the ponding and the flooding. The sides of shallow excavations can cave in unless they are shored. The shoring should be done during a dry period. Constructing roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater and wetness.

The land capability unit is VIw-7, dryland; windbreak suitability group 10. No range site is assigned.

Bg—Blownout land-Valentine complex, 6 to 60 percent slopes. This map unit is in the sandhills. Blownout land is in bowllike depressions that have been hollowed out by the wind. The depressions are 5 to more than 25 feet deep. Some are eroded down to a permanent water table. The deep, excessively drained Valentine soil is in the less sloping areas. Areas of this unit range from 5 to 80 acres in size. They are 50 to 80 percent Blownout land and 20 to 50 percent Valentine soil.

Figure 7.—An area of Almeria fine sandy loam, channeled, which provides excellent wildlife habitat.

The Blownout land consists of very pale brown, loose fine sand that shifts easily as the wind blows. In most areas it does not have a plant cover.

Typically, the Valentine soil has a surface layer of grayish brown, loose fine sand about 3 inches thick. The transition layer is pale brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. In many places about 2 to 12 inches of light brownish gray to very pale brown, loose sand covers the surface.

Included in this unit in mapping are small areas of the poorly drained and very poorly drained Tryon and Marlake soils at the bottom of blowouts. These soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Valentine soil, and the available water capacity is low. The content of organic matter is low in the Blownout land and the Valentine soil. Runoff is slow.

Areas of the Valentine soil support native grasses and are used as range. The vegetation is sparse and grows only on the Valentine soil. The unit is not suited to cropland.

The climax vegetation on the Valentine soil is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 85 percent or more of the total annual forage. Sand lovegrass, blue grama, and sandhill muhly make up the rest. If the range is subject to continuous heavy grazing, the native plants on the Valentine soil lose vigor and are unable to stabilize the site. As a result, the hazard of soil blowing and the extent of Blownout land increase.

Productivity can be restored if the Blownout land is stabilized and native grass is reestablished. Most areas of Blownout land can be reclaimed in 4 or 5 years by a planned grazing system that prevents excessive trampling and overgrazing. Establishing a stable grade on the steep banks and controlling grazing patterns through a planned grazing system allow these areas to be revegetated and stabilized. Reducing the slope of the banks helps to control soil blowing during revegetation. If fences keep livestock out of blowouts, land shaping, seeding, and mulching can accelerate reclamation.

The potential stocking rate on this unit should be determined by onsite evaluation. It varies, depending on the amount of vegetation in the blowouts and the size and distribution of the blowouts. The unit generally is in pastured areas where the range site is Sands or Choppy Sands. Locating watering and salting facilities outside this unit helps to prevent excessive trampling, which can increase the extent of the Blownout land.

After grasses are reestablished, good range management is very effective in controlling soil blowing. Overgrazing can increase the extent of Blownout land. A planned grazing system that includes proper grazing use, timely deferment of grazing, and control of grazing patterns through fencing helps to maintain or improve the range condition in stabilized areas.

This unit is generally unsuited to the trees and shrubs grown as windbreaks. It can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if suitable species are hand planted or other special management is applied.

This unit is not suitable as a site for sanitary facilities or dwellings. A suitable alternative site is needed. The Valentine soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations can cave in unless they are shored. Cutting and filling are needed in some areas to provide a suitable grade for roads.

The land capability unit is VIIe-5, dryland; windbreak suitability group 10. The Valentine soil is in the Sands range site, and Blownout land is not assigned a range site.

BhB—Boelus loamy fine sand, sandy substratum, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil formed in sandy eolian material deposited over loamy and sandy alluvium. It is on stream terraces. Areas range from 20 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 6 inches thick. The subsurface layer is grayish brown, very friable loamy fine sand about 8 inches thick. The subsoil is about 27 inches thick. The upper part is pale brown, loose fine sand. The next part is brown, friable loam. The lower part is brown and light brownish gray, very friable sandy loam. The underlying material to a depth of 60 inches or more is light gray sand. In a few places the surface layer is fine sandy loam or loam.

Included with this soil in mapping are small areas of Hersh, Ipage, Simeon, and Valentine soils. Hersh soils are slightly higher on the landscape than the Boelus soil. They are loamy in the upper part. Ipage and Simeon soils are lower on the landscape than the Boelus soil. They are sandy throughout. Valentine soils also are sandy. They are on hummocks. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the sandy upper part of the Boelus soil, moderate in the loamy layer, and rapid in the sandy underlying material. The available water capacity is moderate. The content of organic matter is moderately low. Runoff is slow. The water intake rate is very high. This soil can be easily tilled throughout a wide range of moisture content.

Most areas of this soil support native grasses and are used for grazing. Some small areas are used as cropland.

If used for dryland farming, this soil is suited to corn, alfalfa, sorghum, and small grain. Soil blowing is a serious hazard. A conservation tillage system that keeps crop residue on the surface helps to control soil blowing and conserves moisture. A cropping system that includes legumes, grasses, or a legume-grass mixture helps to increase the content of organic matter and improves fertility and tilth. Cropping systems that alternate row crops with small grain, grasses, and legumes help to control soil blowing. Insufficient rainfall limits crop production in most years.

If irrigated, this soil is suited to corn, alfalfa, sorghum, and introduced grasses. A sprinkler system is the best method of irrigation because of the very high water intake rate of the soil. Light, frequent applications of irrigation water help to prevent leaching of the plant nutrients below the root zone. Returning crop residue to the soil and applying a system of conservation tillage, such as no-till and till-plant, help to control soil blowing and improve fertility. Keeping cover crops or crop residue on the surface helps to control soil blowing.

Adding barnyard manure to the soil increases the content of organic matter and improves fertility.

In the areas of this soil used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, blue grama, and needleandthread. These species make up 70 percent of the total annual forage. Switchgrass, sedges, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, and weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Areas of this soil are generally the first to be overgrazed in a pasture that includes Sands and Choppy Sands range sites. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture before they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing is a hazard. It can be controlled by maintaining strips of sod or cover crops between the tree rows. Drought and the competition for moisture from grasses and weeds are other management concerns. Irrigation water can provide supplemental moisture during dry periods. Weeds and undesirable grasses in the tree rows can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicides.

This soil generally is suited to use as a site for dwellings and roads. The moderate permeability is a limitation if the soil is used as a site for septic tank absorption fields. It generally can be overcome by increasing the size of the absorption field. The sides of shallow excavations can cave in unless they are shored.

The land capability units are IIIe-5, dryland, and IIIe-11, irrigated; Sandy range site; windbreak suitability group 5.

BkB—Boelus, sandy substratum-Simeon loamy sands, 0 to 3 percent slopes. These deep, nearly level and very gently sloping soils are on stream terraces. The Boelus soil is well drained. It formed in sandy eolian material deposited over loamy and sandy alluvium. The Simeon soil is excessively drained. It formed in sandy and gravelly alluvium. Areas range from 50 to more than 600 acres in size. They are 45 to 65 percent Boelus soil and 20 to 35 percent Simeon soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Boelus soil has a surface layer of dark grayish brown, very friable loamy sand about 5 inches thick. The subsurface layer is grayish brown, very friable loamy sand about 6 inches thick. The subsoil is about 29 inches thick. The upper part is pale brown, loose fine sand. The next part is grayish brown, friable loam. The lower part is grayish brown, very friable fine sandy loam. The underlying material extends to a depth of 60 inches or more. It is grayish brown fine sandy loam in the upper part and light brownish gray sand in the lower part. In some places the loamy layer is less than 10 inches thick. In other places it is at a depth of 37 inches or more.

Typically, the Simeon soil has a surface layer of dark grayish brown, loose loamy sand about 5 inches thick. The transition layer is brown, loose sand about 4 inches thick. The underlying material extends to a depth of 60 inches or more. It is light brownish gray sand in the upper part and light gray coarse sand in the lower part. In some areas the surface layer is sand or sandy loam.

Included with these soils in mapping are small areas of Ipage and Valentine soils. Ipage soils are in landscape positions similar to those of the Simeon soil. They are moderately well drained. They are fine sand throughout. Valentine soils are on hummocks. They contain less sand than the Simeon soil. Also included are a few small areas where the slopes are more than 3 percent. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the sandy upper part of the Boelus soil, moderate in the loamy layer, and rapid in the sandy underlying material. It is rapid in the Simeon soil. The available water capacity is moderate in the Boelus soil and low in the Simeon soil. The content of organic matter is moderately low in the Boelus soil and low in the Simeon soil. The water intake rate is very high in both soils, and runoff is slow.

Most of the acreage of this unit supports native grasses and is used as range. Some areas are used as irrigated cropland. Most areas that were farmed have been reseeded to grass and are used as range. This unit is not suitable for dryland crops because of the droughtiness of the Simeon soil.

If irrigated, these soils are suited to corn, alfalfa, sorghum, and introduced grasses. A sprinkler system is

the best method of irrigation because of the very high water intake rate of the soils. Light, frequent applications of irrigation water help to prevent excessive leaching of the plant nutrients below the root zone. Soil blowing is a severe hazard if the surface is not protected by growing crops or crop residue. Returning crop residue to the soil increases the content of organic matter and improves fertility. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and conserves moisture. Keeping cover crops or crop residue on the surface helps to control soil blowing. Adding barnyard manure to the soils helps to increase the content of organic matter and improves fertility.

In the areas used as rangeland, the climax vegetation on the Boelus soil is dominantly sand bluestem, little bluestem, needleandthread, blue grama, and prairie sandreed. These species make up 70 percent or more of the total annual forage on this soil. Switchgrass, sedges, and forbs make up the rest. The climax vegetation on the Simeon soil is dominantly blue grama, sand bluestem, needleandthread, prairie sandreed, and clubmoss. These species make up 70 percent or more of the total annual forage on this soil. Hairy grama, little bluestem, sand dropseed, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced by needleandthread, blue grama, hairy grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, needleandthread, sedges, common pricklypear, brittle pricklypear, fringed sagewort, and weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre on the Boelus soil and 0.6 animal unit month per acre on the Simeon soil. The stocking rates will depend on the percent of each soil in the pasture. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned short period of heavy grazing during the grazing season or deferment of grazing in 2 years out of 3 can help to retain little bluestem and prairie sandreed in the plant community. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture before they are used as range. The Simeon soil has a low available water capacity and is droughty. The amount of forage produced is dependent on the frequency and amount of seasonal rainfall.

The Boelus soil is suited to the trees and shrubs grown as windbreaks, but the Simeon soil is generally unsuited. Onsite investigation is needed to identify any small areas suitable for windbreaks. If the Boelus soil is used as a site for windbreaks, soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses in the tree rows can be controlled by cultivating with conventional equipment and by timely application of the appropriate herbicides. Irrigation is needed during dry periods.

These soils generally are suited to use as sites for dwellings, small commercial buildings, and roads. The moderate permeability is a limitation if the Boelus soil is used as a site for septic tank absorption fields. It generally can be overcome by increasing the size of the absorption field. The Simeon soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations can cave in unless they are shored.

The land capability units are VIe-5, dryland, and IVe-11, irrigated. The Boelus soil is in the Sandy range site and windbreak suitability group 5. The Simeon soil is in the Shallow to Gravel range site and windbreak suitability group 10.

Bo—Bolent loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil formed in sandy alluvium on bottom land. It is occasionally flooded, but the floodwater remains on the surface for only short periods. Areas generally are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, calcareous, very friable loamy fine sand about 6 inches thick. The underlying material extends to a depth of 60 inches or more. It is stratified light brownish gray and dark grayish brown sand, loamy fine sand, and fine sandy loam in the upper part, and stratified light gray and white, mottled coarse sand, sand, and loamy very fine sand in the lower part. In a few places about 6 to 24 inches of fine sand overwash covers the surface. In some places the surface layer is fine sandy loam or loam. In other places the dark surface layer is more than 9 inches thick.

Included with this soil in mapping are small areas of Almeria and Calamus soils. Almeria soils are lower on the landscape than the Bolent soil and are poorly

drained or very poorly drained. Calamus soils are in the higher positions on the landscape and are moderately well drained. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Bolent soil, and the available water capacity is low. The content of organic matter is moderately low. The water intake rate is very high, and runoff is slow. The seasonal high water table ranges from 1.5 feet below the surface in wet years to about 3.5 feet below the surface in dry years. The water table normally drops to a depth of about 4 to 6 feet in late summer.

Most areas of this soil support native grasses and are used as range or hayland. The rest are used as cropland.

If used for dryland farming, this soil is poorly suited to corn and small grain. Alfalfa is suitable if the water table is not too high. In the spring, the soil may be difficult to work because of the wetness caused by the high water table. Flooding can delay spring planting and limits the production of small grain. Growing alfalfa or other close-grown crops eliminates the need for working the soil in the spring, when it is wet, and helps to control soil blowing when the soil is dry. Stubble mulch tillage and a cropping system that keeps the soil covered with crop residue help to control soil blowing. Returning crop residue to the soil and adding barnyard manure help to increase the content of organic matter and improve fertility.

If irrigated, this soil is poorly suited to corn, small grain, and introduced grasses. A sprinkler system is the best method of irrigation because the water intake rate is very high. Frequent, light applications of water are needed to minimize the leaching of plant nutrients. Wetness caused by the seasonal high water table can delay tillage early in the spring and in other wet periods. A system of conservation tillage that keeps the soil covered with crops or crop residue helps to control soil blowing.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up 70 percent or more of the total annual forage. Prairie cordgrass and sedges make up the rest. If the range is subject to continuous heavy grazing or is improperly harvested for hay, big bluestem, little bluestem, indiangrass, switchgrass, and prairie cordgrass decrease in abundance and are replaced by sideoats grama, western wheatgrass, bluegrass, foxtail barley, slender wheatgrass, green muhly, sedges, and rushes. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods helps to maintain or improve the range condition. Areas of this soil are generally the first to be overgrazed in a pasture that includes better drained, sandy soils. Properly located fences and watering and salting facilities result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The hay is of best quality when the grasses are cut early. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in the spring, before the ground thaws.

This soil is suited to the trees and shrubs grown as windbreaks. The only suitable species are those that can tolerate the seasonal high water table. Tilling the soil and planting the trees in spring may not be possible until the water table drops and the soil begins to dry out. Weeds and undesirable grasses that grow in the tree rows can be controlled by timely cultivation or by applications of approved herbicide.

This soil is not suited to use as a site for sanitary facilities or dwellings because of the hazard of flooding. A suitable alternative site is needed. The sides of shallow excavations can cave in unless they are shored. The shoring should be done during a dry period. Constructing roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater and wetness.

The land capability units are IVw-5, dryland, and IVw-11, irrigated; Subirrigated range site; windbreak suitability group 2S.

Cm—Calamus loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil formed in sandy alluvium on bottom land. It is subject to rare flooding. Areas of this soil are dissected by shallow drainage channels. They range from 10 to more than 200 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 5 inches thick. The transition layer is light brownish gray, loose fine sand about 9 inches thick. The underlying material extends to

a depth of 60 inches or more. The upper part is light gray sand stratified with coarse sand, fine sand, and fine sandy loam. The lower part is light gray gravelly coarse sand. It is mottled below a depth of about 30 inches. In some places the surface layer is fine sandy loam or fine sand. In other places the soil has a dark surface layer more than 9 inches thick.

Included with this soil in mapping are small areas of Almeria and Bolent soils. These soils are lower on the landscape than the Calamus soil. Almeria soils are poorly drained and very poorly drained. Bolent soils are somewhat poorly drained. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Calamus soil. The available water capacity and the content of organic matter are low. Runoff is slow. The water intake rate is very high. The seasonal high water table ranges from 3 feet below the surface in wet years to 6 feet below the surface in dry years.

Most of the acreage supports native grasses and is used as range. Some areas are used as irrigated cropland. This soil is not suitable for dryland crops because it is too droughty.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. It is too sandy for gravity irrigation. Frequent, light applications of irrigation water are needed to minimize the leaching of plant nutrients. Soil blowing is a severe hazard. Keeping crop residue on the surface helps to control soil blowing. Returning crop residue to the soil and applying barnyard manure help to increase the content of organic matter and improve fertility.

In the areas of this soil used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 85 percent or more of the total annual forage. Blue grama, indiangrass, forbs, and sedges make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, indiangrass, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Maintaining strips of sod or cover crops between the tree rows helps to control soil blowing. Cultivation should be restricted to the tree rows. Supplemental water is needed during dry periods. Areas near the trees can be rototilled or hoed by hand.

The rare flooding is a hazard if this soil is used as a site for sanitary facilities or dwellings. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. Septic tank absorption fields should be constructed on fill material that raises them a sufficient distance above the seasonal high water table. Constructing dwellings on raised, well compacted fill material helps to prevent the damage caused by floodwater. Constructing roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater.

The land capability units are VIe-5, dryland, and IVe-14, irrigated; Sandy range site; windbreak suitability group 7.

CrG—Coly-Hobbs silt loams, 2 to 60 percent slopes. These deep soils are on loess-covered uplands deeply dissected by narrow drainageways. The steep and very steep, excessively drained Coly soil is on the sides of canyons and on narrow ridgetops between the canyons. It formed in loess. The canyon sides commonly have a succession of short, vertical exposures called catsteps. The very gently sloping, well drained Hobbs soil is on the narrow bottom land below the canyon sides (fig. 8). It is formed in silty alluvium. It is occasionally flooded for short periods. Areas range from 40 to more than 500 acres in size. They are 65 to 80 percent Coly soil and 15 to 25 percent Hobbs soil. The two soils occur as areas so small or so narrow that separating them in mapping is not practical.

Typically, the Coly soil has a surface layer of grayish brown, very friable, calcareous silt loam about 5 inches thick. The transition layer is light brownish gray, very friable, calcareous silt loam about 5 inches thick. The underlying material to a depth of 60 inches or more is very pale brown. It is calcareous silt loam in the upper part and calcareous very fine sandy loam in the lower part. In some areas sandy eolian material is on the surface. In a few places the canyon sides are vertical escarpments. The loess is exposed on these escarpments.

Figure 8.—An area of Coly-Hobbs silt loams, 2 to 60 percent slopes. The Hobbs soil is on the bottom land, and the Coly soil is on the side slopes.

Typically, the Hobbs soil has a surface layer of grayish brown, very friable silt loam about 6 inches thick. The underlying material extends to a depth of 60 inches or more. In sequence downward, it is stratified dark grayish brown and light gray silt loam; dark grayish brown silt loam; pale brown silt loam; and stratified very pale brown and brown silt loam and very fine sandy loam. In a few places the surface layer is loamy fine sand or fine sandy loam. In some areas thin layers of fine sandy loam and loamy fine sand are in the underlying material. In places the underlying material is calcareous.

Included with these soils in mapping are small areas of Cozad, Hersh, and Uly soils. Cozad and Uly soils have a surface soil that is thicker than that of the Coly soil. Cozad soils are on stream terraces along the narrow drainageways. Uly soils are on the upper side slopes in the uplands. Hersh soils are on side slopes and ridgetops in the uplands. They have more sand than the Coly and Hobbs soils. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Coly and Hobbs soils, and the available water capacity is high. The content of organic matter is moderately low in the Coly soil and moderate in the Hobbs soil. Runoff is very rapid on the Coly soil and slow on the Hobbs soil.

Nearly all of the acreage of this unit supports native grasses and is used as range. The Coly soil is not suitable for cultivated crops because of the slope. A few of the more accessible areas of the Hobbs soil are used

as cropland. The steep and very steep side slopes support some trees and shrubs. These soils provide good habitat for wildlife.

In the areas of this unit used as range, the climax vegetation on the Coly soil is dominantly big bluestem, little bluestem, sideoats grama, and plains muhly. These species make up 70 percent or more of the total annual forage on this soil. Indiangrass, switchgrass, sedges, and forbs make up the rest. The climax vegetation on the Hobbs soil is dominantly big bluestem, little bluestem, western wheatgrass, sideoats grama, and switchgrass. These species make up 80 percent or more of the total annual forage on this soil. Blue grama, sedges, and forbs make up the rest.

If the range is subject to continuous heavy grazing, big bluestem and switchgrass decrease in abundance on these soils. On the Coly soil, these species are replaced by blue grama, hairy grama, plains muhly, prairie sandreed, needleandthread, and forbs. On the Hobbs soil, they are replaced by sideoats grama, western wheatgrass, blue grama, and bluegrass. If overgrazing continues for many years, the plants lose vigor and are unable to stabilize the site. As a result, water erosion is excessive on the Coly soil. Flooding, although brief in duration, causes channeling and the deposition of debris and weed seeds on the Hobbs soil.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre on the Coly soil and 1.0 animal unit month per acre on the Hobbs soil. A planned grazing system that includes proper grazing use and timely deferment of grazing can help to maintain or improve the range condition. Properly using the Coly soil without overusing the Hobbs soil is a management problem. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. The very steep slopes make it difficult for range animals to cross some areas of these soils.

The Coly soil is generally unsuited to the trees and shrubs grown as windbreaks, but the Hobbs soil is suited. Weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivation between the rows with conventional equipment or by careful application of the appropriate herbicides. Supplemental water is needed during dry periods. Onsite investigation is needed to identify any small areas of the Coly soil suitable for windbreaks. Other areas can be used for the trees or shrubs that enhance recreation areas or wildlife habitat if suitable species are planted by hand or other special management is applied.

These soils are not suitable as sites for sanitary facilities or dwellings because of the steep and very steep slope of the Coly soil and the hazard of flooding on the Hobbs soil. Suitable alternative sites are needed. Cutting and filling are needed on the Coly soil to provide a suitable grade for roads. Roads constructed on the Hobbs soil should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarse grained base material helps to ensure better performance. Constructing the roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater.

The land capability unit is VIIe-9, dryland. The Coly soil is in the Thin Loess range site and windbreak suitability group 10. The Hobbs soil is in the Silty Overflow range site and windbreak suitability group 1.

Cs—Cozad silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil formed in alluvium on stream terraces along the North Loup River and its tributaries. The soil is subject to rare flooding. Areas range from 25 to 500 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 6 inches thick. The subsurface layer also is grayish brown, very friable silt loam about 6 inches thick. The subsoil is very friable silt loam about 14 inches thick. It is light brownish gray in the upper part and light gray and calcareous in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam. In places the surface soil is less than 7 or more than 20 inches thick. In some areas land leveling has exposed the subsoil or the sandier underlying material. In other areas the underlying material is mottled below a depth of 30 inches and is loamy fine sand or loamy very fine sand.

Included with this soil in mapping are small areas of Hersh and Hord soils. Hersh soils are on the slightly higher ridges. They have more sand than the Cozad soil. Hord soils are in positions on the landscape similar to those of the Cozad soil. They are dark to a depth of 20 to 40 inches. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Cozad soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is slow. The soil can be easily tilled. It absorbs water well and readily releases moisture to plants. The water intake rate is moderate.

Most areas of this soil are used for irrigated crops. The rest are used for dryland crops or for range.

If used for dryland farming, this soil is suited to corn,

sorghum, small grain, and alfalfa. Crop production is limited in most years because of insufficient seasonal rainfall. Soil blowing is a hazard unless the surface is protected by crops or crop residue. A conservation tillage system that leaves crop residue on the surface helps to conserve moisture and control soil blowing. Returning crop residue and green manure crops to the soil helps to increase the content of organic matter and improves fertility and tilth.

If irrigated, this soil is suited to corn, sorghum, alfalfa, small grain, and introduced grasses. Water can be applied by gravity or sprinkler irrigation systems. Land leveling may be needed if a gravity system is used. Proper management of irrigation water is needed. Disking, chiseling, or another system of conservation tillage that keeps crop residue on the surface helps to conserve moisture and control soil blowing. Applying barnyard manure and returning crop residue to the soil increase the rate of water infiltration and the content of organic matter and improve fertility.

This soil is suited to range and native hay. A cover of range plants or native hay is effective in controlling soil blowing. Continuous heavy grazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Irrigation is needed during periods of insufficient rainfall. Good site preparation, timely cultivation, and timely applications of appropriate herbicide help to control the weeds and undesirable grasses that compete with the trees and shrubs for moisture.

The hazard of rare flooding should be considered if this soil is used as a site for sanitary facilities or dwellings. Constructing dwellings on raised, well compacted fill material helps to prevent the damage caused by floodwater. The moderate permeability is a limitation on sites for septic tank absorption fields, but it generally can be overcome by increasing the size of the absorption field.

Flooding and frost action are hazards if this soil is used as a site for roads. Constructing the roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the damage caused by floodwater. The damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIc-1, dryland, and I-6, irrigated; Silty Lowland range site; windbreak suitability group 1.

CsB—Cozad silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in silty alluvium on stream terraces along the North Loup River and its tributaries. Areas range from 5 to 80 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 6 inches thick. The subsurface layer is gray, very friable silt loam about 9 inches thick. The subsoil is light brownish gray, very friable silt loam about 12 inches thick. The underlying material to a depth of 60 inches or more is light gray, calcareous silt loam. In places the surface soil is less than 7 or more than 20 inches thick. In some areas land leveling has exposed the sandier underlying material.

Included with this soil in mapping are small areas of Hersh and Hord soils. Hersh soils are higher on the landscape than the Cozad soil. Also, they contain more sand. Hord soils are in positions on the landscape similar to those of the Cozad soil. Their surface soil is thicker than that of the Cozad soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Cozad soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is slow or medium. This soil can be easily tilled. The water intake rate is moderate. The soil absorbs water well and readily releases moisture to plants.

Nearly all areas of this soil are used for cultivated crops. The rest support native grasses and are used as range. A large acreage is irrigated.

If used for dryland farming, this soil is suited to corn, sorghum, small grain, alfalfa, and introduced grasses. Soil blowing is a hazard unless the surface is protected by crops or crop residue. Water erosion is a slight hazard. A system of conservation tillage, such as disking or chiseling, that keeps crop residue on the surface helps to conserve moisture and control erosion. Returning crop residue and green manure crops to the soil increases the content of organic matter and improves fertility and tilth.

If irrigated, this soil is suited to corn, sorghum, alfalfa, small grain, and introduced grasses. Water can be applied by gravity or sprinkler irrigation systems. Land leveling may be needed if a gravity system is used. Proper management of irrigation water is needed.

A system of conservation tillage, such as disking or chiseling, that keeps crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil helps to increase the content of organic matter and improves fertility.

This soil is suited to range and native hay. A cover of range plants or native hay is effective in controlling soil blowing and water erosion. Continuous heavy grazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Supplemental watering can provide the moisture needed during periods of low rainfall. Weeds and undesirable grasses in the rows can be controlled by timely cultivation and by applications of the appropriate herbicides.

The hazard of rare flooding should be considered if this soil is used as a site for sanitary facilities or dwellings. The moderate permeability is a limitation if the soil is used as a site for septic tank absorption fields. It generally can be overcome by increasing the size of the absorption field. Constructing dwellings on raised, well compacted fill material helps to prevent the damage caused by floodwater.

Flooding and frost action are hazards if this soil is used as a site for roads. Constructing the roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the damage caused by floodwater. The damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIe-1, dryland, and IIe-6, irrigated; Silty Lowland range site; windbreak suitability group 1.

Eb—Els loamy sand, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil formed in sandy eolian and alluvial material. It is in sandhill valleys and on stream terraces. This soil is subject to rare flooding. Areas range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable loamy sand about 6 inches thick. The transition layer is grayish brown, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is mottled fine sand. It is light brownish gray in the upper part and light gray in the lower part. In some areas the surface layer is fine sand or loamy fine sand. In places the surface soil is more than 10 inches thick.

Included with this soil in mapping are small areas of Ipage and Tryon soils. Ipage soils are higher on the landscape than the Els soil and are moderately well drained. Tryon soils are in the lower areas and are poorly drained or very poorly drained. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Els soil, and the available water capacity is low. The content of organic matter is moderately low. Runoff is slow. The water intake rate is very high. Depth to the seasonal high water table ranges from about 1.5 feet in wet years to about 3.0 feet in dry years.

Most of the acreage of this soil supports native grasses and is used for native hay or grazing. A small acreage is used for irrigated crops.

If used for dryland farming, this soil is poorly suited to cropland. It is better suited to small grain than to other crops. Growing small grain and other close-grown crops eliminates the need for working the soil in the spring. Alfalfa may drown out in low areas. Working the soil is difficult in the spring and in other wet periods. Keeping crops or crop residue on the surface helps to control soil blowing.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. The high water table drowns out alfalfa in some areas. The soil is too sandy for gravity irrigation. Applying small amounts of irrigation water at frequent intervals minimizes the leaching of plant nutrients. The seasonal high water table can be a problem in the spring and in other wet periods. Tiling is normally not required in irrigated areas. Soil blowing can be controlled by keeping the surface covered with crops or crop residue. Applying barnyard manure increases the content of organic matter and improves fertility.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up 85 percent or more of the total annual forage. Prairie cordgrass, sedges, and forbs make up the rest. If the range is subject to continuous heavy grazing or improperly harvested for hay, big bluestem, little bluestem, indiangrass, switchgrass, and prairie cordgrass decrease in abundance and are replaced by sideoats grama, western wheatgrass, bluegrass, foxtail barley, slender wheatgrass, green muhly, sedges, and rushes. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, and weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods helps to keep the native plants in good condition. Areas of this soil are generally the first to be overgrazed in a pasture that includes better drained, sandy soils. Properly located fences, livestock water, and salting facilities result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The hay is of best quality when the grasses are cut early. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in the spring, before the ground thaws.

This soil is suited to the trees and shrubs grown as windbreaks. The only suitable species are those that can withstand the occasional wetness. Tilling the soil and planting the trees in the spring may not be possible until the soil has begun to dry. Weeds and undesirable grasses in the tree rows can be controlled by cultivating between the rows with conventional equipment. Areas near the trees can be hoed by hand or rototilled. Growing cover crops between the tree rows helps to control soil blowing.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The absorption fields should be constructed on fill material that raises them a sufficient distance above the seasonal high water table. The sides of shallow excavations can cave in unless they are shored. The shoring should be done during a dry period. Constructing dwellings on raised, well compacted fill material helps to reduce the wetness caused by the seasonal high water table and helps to prevent the damage caused by floodwater. Constructing roads on suitable, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater and wetness. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVw-5, dryland, and IVw-11, irrigated; Subirrigated range site; windbreak suitability group 2S.

EfB—Els-Ipage fine sands, 0 to 3 percent slopes. These deep, nearly level and very gently sloping soils formed in sandy eolian and alluvial material on stream terraces and in sandhill valleys. The Els soil is somewhat poorly drained, and the Ipage soil is moderately well drained. The Els soil is subject to rare flooding. Areas range from 40 to more than 500 acres in size. They are 50 to 65 percent Els soil and 20 to 45 percent Ipage soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Els soil has a surface layer of grayish brown, very friable fine sand about 6 inches thick. The transition layer is light brownish gray, loose fine sand about 8 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand. In some areas the surface layer is loamy sand or loamy fine sand.

Typically, the Ipage soil has a surface layer of grayish brown, very friable fine sand about 5 inches thick. The transition layer is light brownish gray, loose fine sand about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown and light gray fine sand. It has mottles below a depth of 36 inches.

Included with these soils in mapping are small areas of Marlake, Tryon, and Valentine soils. Marlake and Tryon soils are in the lower areas. Marlake soils have water on the surface most of the time. Tryon soils are poorly drained and very poorly drained. Valentine soils are in the higher areas and are excessively drained. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Els and Ipage soils, and the available water capacity is low. The content of organic matter is moderately low in the Els soil and low in the Ipage soil. Runoff is slow on both soils. The water intake rate is very high. Depth to the seasonal high water table in the Els soil ranges from 1.5 feet in wet years to about 3.0 feet in dry years. Depth to the seasonal high water table in the Ipage soil ranges from about 3 feet in wet years to about 6 feet in dry years.

Most of the acreage supports native grasses and is used as range or hayland. The rest is used mainly as irrigated cropland. This unit is not suited to dryland crops because soil blowing is a severe hazard on the Ipage soil.

If irrigated, these soils are poorly suited to corn, alfalfa, small grain, and introduced grasses. They are too sandy for gravity irrigation, but they can be irrigated by sprinklers. Soil blowing is a severe hazard if the surface is not adequately protected by crops or crop residue. Wetness is a problem in the Els soil during the

spring and during other wet periods. Returning crop residue to the soil and applying barnyard manure help to increase the content of organic matter and improve fertility.

These soils are suited to range and native hay. The climax vegetation on the Els soil is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up 85 percent or more of the total annual forage on this soil. Prairie cordgrass, sedges, and forbs make up the rest. The climax vegetation on the Ipage soil is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage on this soil. Blue grama, indiangrass, switchgrass, sedges, and forbs make up the rest.

If the range is subject to continuous heavy grazing or improperly harvested for hay, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance on the Els soil and are replaced by bluegrass, slender wheatgrass, sideoats grama, green muhly, sedges, and rushes. Sand bluestem, little bluestem, and switchgrass decrease in abundance on the Ipage soil and are replaced by blue grama, needleandthread, prairie sandreed, sand dropseed, sedges, and forbs. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, and forbs dominate the site and blowouts may form.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre on the Els soil and 1.0 animal unit month per acre on the Ipage soil. Proper grazing use, timely deferment of grazing, and restricted use during wet periods help to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture before they are used as range.

If these soils are used as hayland, mowing should be regulated so that the grasses remain vigorous. Large meadows can be divided into sections and the sections mowed in rotation. Hay should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. After the ground is frozen, livestock can graze without damaging the meadow. They should be removed in the spring, before the ground thaws.

These soils are suited to the trees and shrubs grown as windbreaks. The only suitable species on the Els soil are those that can tolerate occasional wetness. Establishing seedlings can be difficult in wet years. Tilling the soil and planting the trees in the spring may not be possible until the soil dries out. Weeds and undesirable grasses can be controlled by timely cultivation or by applications of approved herbicide. The Ipage soil is so loose that the trees should be planted in shallow furrows with as little disturbance of the surface as possible. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. Young seedlings can be damaged by high winds and covered by drifting sand. Irrigation can provide the supplemental moisture needed during periods of low rainfall.

These soils readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The absorption fields should be constructed on fill material that raises them a sufficient distance above the seasonal high water table. The sides of shallow excavations can cave in unless they are shored. The shoring should be done during a dry period. Constructing dwellings on raised, well compacted fill material helps to overcome the wetness caused by the seasonal high water table and helps to prevent the damage caused by floodwater on the Els soil. Constructing roads on suitable, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater and wetness. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated. The Els soil is in the Subirrigated range site and windbreak suitability group 2S. The Ipage soil is in the Sandy Lowland range site and windbreak suitability group 7.

Em—Elsmere loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil formed in sandy alluvium on stream terraces. Areas range from 40 to more than 300 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 6 inches thick. The subsurface layer is grayish brown and dark grayish brown, very friable loamy fine sand about 8 inches thick. The underlying material to a depth of 60 inches or more is light gray. It is very fine sandy loam in the upper 6 inches and mottled fine sand in the lower part. In some areas the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Ipage and Ord soils. Ipage soils are slightly higher on

the landscape than the Elsmere soil and are moderately well drained. Ord soils are on bottom land. They are loamy in the upper part. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Elsmere soil. The available water capacity is low. The content of organic matter is moderately low. Runoff is slow. The water intake rate is very high. Depth to the seasonal high water table ranges from 1.5 feet in wet years to about 3.0 feet in dry years. The water table normally drops to a depth of 5 or 6 feet in late summer.

Most of the acreage of this soil is used for cultivated crops. The rest supports native grass and is used as range or hayland.

If used for dryland farming, this soil is poorly suited to corn, alfalfa, small grain, and introduced grasses. Working the soil may be difficult in the spring and in other wet periods. Crop production is limited in most years because of insufficient seasonal rainfall. Soil blowing is a slight hazard. It can be controlled by a system of stubble mulch tillage that keeps the soil covered with crop residue most of time. Returning crop residue to the soil and adding barnyard manure help to increase the content of organic matter and improve fertility.

If irrigated, this soil is suited to corn and alfalfa. A sprinkler system is the best method of applying irrigation water because the water intake rate is high. Frequent light applications of water minimize the leaching of plant nutrients. The high water table is a management concern. Winter cover crops and a conservation tillage system that keeps crop residue on the surface help to control soil blowing.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly big bluestem, little bluestem, prairie cordgrass, indiangrass, switchgrass, and sedges. These species make up 80 percent or more of the total annual forage. Bluegrass, other perennial grasses, and forbs make up the rest. If the range is subject to continuous heavy grazing or improperly harvested for hay, big bluestem, little bluestem, indiangrass, switchgrass, and prairie cordgrass decrease in abundance and are replaced by western wheatgrass, bluegrass, foxtail barley, sedges, and rushes. If overgrazing or improper haying continues for many years, bluegrass, sedges, and weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods helps to maintain or improve the range condition. Areas of this soil are generally the first to be overgrazed in a pasture that includes better drained, sandy soils. Properly located fences, livestock water, and salting facilities result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The hay is of best quality when the grasses are cut early. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in the spring, before the ground thaws.

This soil is suited to the trees and shrubs grown as windbreaks. The only suitable species are those that can withstand a high water table. Establishing seedlings can be difficult during wet years. Tilling the soil and planting the trees may not be possible until the water table drops and the soil begins to dry out. The weeds and undesirable grasses that grow in the tree rows compete with the trees and shrubs for moisture. Plant competition can be controlled by cultivating with conventional equipment and by timely applications of appropriate herbicides.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The absorption fields should be constructed on fill material that raises them a sufficient distance above the seasonal high water table. The sides of shallow excavations can cave in unless they are shored. The shoring should be done during a dry period. Constructing dwellings on raised, well compacted fill material helps to overcome the wetness caused by the high water table. Constructing roads on suitable, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the road damage caused by wetness. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate roadside ditches help provide the needed surface drainage.

The land capability units are IVw-5, dryland, and IVw-11, irrigated; Subirrigated range site; windbreak suitability group 2S.

Fu—Fluvaquents, sandy. These deep, nearly level and very gently sloping, very poorly drained soils formed in sandy alluvium on low bottom land adjacent

to streams and river channels. They are frequently flooded. Areas range from 5 to more than 100 acres in size.

Typically, the surface layer is black, undecomposed organic material about 2 inches thick. The subsurface layer is stratified very dark gray to light brownish gray, very friable fine sand, loamy fine sand, and fine sandy loam. It is about 10 inches thick. The underlying material to a depth of 60 inches or more is dark gray to white, mottled fine sand and sand. It has thin strata of loam to coarse sand. The texture, color, and thickness of the soil layers vary widely from one area to another.

Included with these soils in mapping are small areas of Almeria and Loup soils. These included soils are slightly higher on the landscape than the Fluvaquents and are not covered by water during most of the growing season. They make up less than 10 percent of the unit.

Permeability is rapid in the Fluvaquents, and the available water capacity is low. The content of organic matter is high. The seasonal high water table is about 2 feet above the surface in wet years and is within a depth of about 1 foot in dry years. In most years water covers the surface during most of the growing season.

These soils provide good habitat for wetland wildlife. They are not suited to cropland, hayland, or range because they are too wet. The vegetation that grows on the soils is coarse and not palatable to livestock. It consists mainly of indigobush, cattails, ferns, rushes, arrowheads, and other water-tolerant plants. Areas of these soils provide good nesting sites and cover for wetland wildlife.

These soils are not suited to the trees and shrubs grown as windbreaks because of the wetness and the flooding. A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat if suitable species are hand planted or other special management is applied.

These soils are not suitable as sites for sanitary facilities or dwellings because of the flooding and the wetness. A suitable alternative site is needed. Constructing roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater and wetness.

The land capability unit is VIIIw-7; windbreak suitability group 10. No range site is assigned.

GfB—Gates silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on uplands. It formed in loess and reworked loamy material. Areas range from 5 to 40 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 6 inches thick. The transition layer is light brownish gray, very friable silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown silt loam. Lime is at a depth of about 21 inches. In some areas the surface layer is fine sandy loam. In a few places it is more than 7 inches thick. In places the entire profile is noncalcareous.

Included with this soil in mapping are small areas of Hersh and Valentine soils. Hersh soils are in positions on the landscape similar to those of the Gates soil. They contain more sand than the Gates soil. Valentine soils are on small dunes. They are sandy throughout. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Gates soil, and the available water capacity is high. The content of organic matter is low. Runoff is slow or medium. The water intake rate is moderate.

Most of the acreage of this soil is used as cropland. The rest supports native grasses and is used as range or hayland. Some areas that formerly were farmed have been reseeded to grass.

If used for dryland farming, this soil is suited to corn, sorghum, small grain, and alfalfa. The principal management concerns are controlling soil blowing, conserving soil moisture, improving fertility, and increasing the content of organic matter. A cropping system that keeps crop residue on the surface helps to control soil blowing, conserves moisture, and increases the content of organic matter. Growing green manure crops, returning crop residue to the soil, and adding barnyard manure improve fertility and tilth. The soil can be easily worked.

If irrigated, this soil is suited to corn, sorghum, alfalfa, small grain, and introduced grasses. It is suited to gravity and sprinkler methods of irrigation, but some land shaping is needed if a gravity system is used. Maintaining fertility and properly distributing irrigation water are the main management problems. Keeping crop residue on the surface conserves moisture and helps to control soil blowing.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Continuous heavy grazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. Overgrazing also increases the susceptibility to soil blowing. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as

windbreaks. Drought and competition for moisture from weeds and grasses are the main problems. Irrigation is needed during dry periods. Cultivation between the tree rows with conventional equipment and timely applications of carefully selected herbicides help to control undesirable weeds and grasses.

This soil generally is suitable as a site for septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are temporarily shored. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIe-9, dryland, and IIe-6, irrigated; Silty range site; windbreak suitability group 3.

GfC2—Gates silt loam, 3 to 6 percent slopes, eroded. This deep, gently sloping, well drained soil is on side slopes in the uplands. It formed in loess and reworked loamy material. In a few areas it is hummocky. Much of the original surface layer has been eroded away, and the remaining surface layer has been mixed with the transition layer by tillage. Areas range from 10 to 100 acres in size.

Typically, the surface layer is brown, very friable, calcareous silt loam about 5 inches thick. The transition layer is pale brown, very friable, calcareous silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam. In a few areas the soil has a dark surface layer more than 7 inches thick. In places the surface layer is fine sandy loam. In severely eroded areas the very pale brown underlying material is exposed. In areas of native grass, the surface layer is darker and the depth to carbonates is more than 15 inches. In a few areas the entire profile is noncalcareous.

Included with this soil in mapping are small areas of Hersh and Valentine soils. Hersh soils are in positions on the landscape similar to those of the Gates soil, and Valentine soils are in the slightly higher positions. Both soils contain more sand than the Gates soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the Gates soil, and the available water capacity is high. The content of organic matter is low. Runoff is medium. The water intake rate is moderate. Because of the low content of organic matter, the soil may puddle if worked when too wet.

A large acreage of this soil is farmed. The rest supports native grasses and is used as range or hayland. Some areas that formerly were farmed have been seeded to grass.

If used for dryland farming, this soil is suited to corn, sorghum, small grain, and alfalfa. Insufficient rainfall is a management concern. Water erosion is a severe hazard in cultivated areas. Terraces, contour farming, and grassed waterways help to control runoff and reduce the hazard of erosion. Keeping crop residue on the surface and applying a system of conservation tillage, such as disking or chiseling, that keeps crop residue on the surface help to control erosion and conserve moisture. Applications of barnyard manure improve fertility and tilth.

If irrigated, this soil is suited to corn, sorghum, alfalfa, small grain, and introduced grasses. It is better suited to close-growing crops than to row crops. A sprinkler system is the best method of irrigation. The rate at which irrigation water is applied should be adjusted to the water intake rate of the soil. Water erosion is the principal hazard. Maintaining fertility and properly distributing irrigation water are management concerns. Terracing, establishing grassed waterways, and keeping crops or crop residue on the surface help to control erosion. A cover of crop residue increases the water intake rate and reduces the hazard of erosion.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Continuous heavy grazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. Overgrazing also can result in water erosion and soil blowing. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are drought and water erosion. Irrigation is needed during periods of low rainfall. Planting on the contour helps to control erosion. Cultivation between the tree rows with conventional equipment and timely applications of carefully selected herbicides help to control the undesirable weeds and grasses that compete with the trees and shrubs for moisture.

This soil generally is suitable as a site for septic tank absorption fields and dwellings. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. The sides of shallow excavations can cave in unless they are temporarily shored. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches

help to provide the needed surface drainage.

The land capability units are IIIe-9, dryland, and IIIe-6, irrigated; Silty range site; windbreak suitability group 3.

GfD—Gates silt loam, 6 to 11 percent slopes. This deep, strongly sloping, well drained soil is on side slopes or along the sides of drainageways in the uplands. In some areas it is hummocky. It formed in loess and reworked loamy material. Areas range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 4 inches thick. The transition layer is brown, very friable silt loam about 6 inches thick. The upper part of the underlying material is pale brown silt loam. The lower part to a depth of 60 inches or more is very pale brown very fine sandy loam. Lime is at a depth of about 30 inches. In some areas the soil has a dark surface layer more than 7 inches thick. In places the surface layer is fine sandy loam. In areas that have been cultivated, the surface layer is lighter colored and carbonates are closer to the surface. In severely eroded areas the carbonates are at the surface. In places the entire profile is noncalcareous.

Included with this soil in mapping are small areas of Hersh, Hobbs, and Valentine soils. Hersh and Valentine soils contain more sand than the Gates soil. Hersh soils are in positions on the landscape similar to those of the Gates soil. Valentine soils are in the slightly higher areas and are excessively drained. Hobbs soils have a surface layer that is stratified and is darker and thicker than that of the Gates soil. They are on bottom land along the larger drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Gates soil, and the available water capacity is high. The content of organic matter is low. Runoff is medium. The water intake rate is moderate. Because of the low content of organic matter, the soil puddles if worked when too wet.

This soil is used mostly for range. A few areas are used as cropland. Some areas that formerly were farmed have been reseeded to grass.

If used for dryland farming, this soil is poorly suited to cropland. It is better suited to alfalfa and small grain than to row crops. Alfalfa and small grain grow and mature in the spring, when the amount of rainfall is highest. Water erosion is a severe hazard in cultivated areas. It can be controlled by terraces, contour farming, and grassed waterways. Disking, chiseling, or another system of conservation tillage that leaves significant amounts of crop residue on the surface after planting conserves moisture, improves tilth, and helps to control erosion and runoff.

If irrigated, this soil is poorly suited to cropland because the hazard of water erosion is severe. A sprinkler system is the only suitable method of irrigation. Controlling erosion is difficult because of the strong slopes. Irrigation water should be applied in sufficient amounts to meet the needs of the crop and at a rate that permits maximum absorption and results in minimum runoff. Terraces, grassed waterways, and a protective cover of crop residue help to control erosion and conserve moisture.

In the areas of this soil used as range, the climax vegetation is dominated by big bluestem, little bluestem, indiangrass, sideoats grama, and switchgrass. These species make up 70 percent or more of the total annual forage. Blue grama, needleandthread, sedges, and forbs make up the rest. If the range is subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance and are replaced by blue grama, needleandthread, plains muhly, tall dropseed, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. In areas where gullies have formed because of severe water erosion, land shaping and timely deferment of grazing are needed to stabilize the site. Deferring grazing after mechanical practices are applied helps to restore plant vigor. Range seeding improves the quality and quantity of forage in formerly cultivated areas.

This soil is suited to the trees and shrubs grown as windbreaks. Drought and water erosion are the main hazards. Irrigation is needed during periods of low rainfall. Planting on the contour and terracing help to control erosion and runoff. Tree growth may be somewhat slower on the steepest slopes. Competition for moisture from grasses and weeds can be controlled by cultivating between the tree rows with conventional equipment, by growing annual cover crops between the rows, and by applying carefully selected herbicides in the rows.

This soil is suited to septic tank absorption fields

where slopes are less than 8 percent. Where slopes are more than 8 percent, land shaping is needed and the absorption field should be installed on the contour. The sides of shallow excavations can cave in unless they are temporarily shored. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. The damage to roads caused by frost action in this soil can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage. Cutting and filling are needed to provide a suitable grade.

The land capability units are IVe-9, dryland, and IVe-6, irrigated; Silty range site; windbreak suitability group 3.

GfF—Gates silt loam, 11 to 30 percent slopes. This deep, moderately steep and steep, somewhat excessively drained soil is along the sides of upland drainageways. It formed in loess and reworked loamy material. Areas range from 25 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The transition layer is pale brown, very friable silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is silt loam. It is pale brown in the upper part and very pale brown in the lower part. Lime is at a depth of about 22 inches. In some areas the dark surface layer is more than 7 inches thick. In places lime is at the surface. In a few areas the entire profile is noncalcareous.

Included with this soil in mapping are small areas of Hersh, Hobbs, and Valentine soils. Hersh and Valentine soils are in positions on the landscape similar to those of the Gates soil. They contain more sand than the Gates soil. Hobbs soils have a surface layer that is stratified and is darker and thicker than that of the Gates soil. They are on bottom land along drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Gates soil, and the available water capacity is high. The content of organic matter is low. Runoff is rapid. The water intake rate is moderate.

This soil generally supports native grasses and is used as range. It is not suited to dryland or irrigated crops because of the slope and a severe hazard of water erosion in cultivated areas.

In the areas of this soi used as range, the native climax vegetation is dominantly big bluestem, little bluestem, indiangrass, sideoats grama, and switchgrass. These species make up 70 percent or more of the total annual forage. Blue grama, needleandthread, sedges, and forbs make up the rest. If the range is subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance and are replaced by blue grama, needleandthread, plains muhly, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be required to smooth and stabilize the site before it is reseeded.

This soil is generally unsuited to the trees and shrubs grown as windbreaks. Planting the trees on the steep slopes is difficult, and water erosion is a severe hazard. Onsite investigation is needed to identify any small areas suitable for windbreaks. Some areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat if suitable species are hand planted or other special management is applied.

This soil generally is not suitable as a site for sanitary facilities because of the slope. A suitable alternative site is needed. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient. Cutting and filling are needed to provide a suitable grade for roads.

The land capability unit is VIe-9, dryland; Silty range site; windbreak suitability group 10.

HeB—Hersh fine sandy loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on uplands. It formed in mixed loamy and sandy eolian material. Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The transition layer is pale brown, very friable fine sandy loam about 6 inches thick. The underlying material extends to a depth of 60 inches or more. It is light

yellowish brown fine sandy loam in the upper part, and very pale brown loamy very fine sand in the lower part. It has layers of finer or coarser textured material. In some areas the dark surface layer is more than 7 inches thick. In other areas the surface layer is silt loam, very fine sandy loam, or loamy fine sand. In places silty material is at a depth of 40 inches or more.

Included with this soil in mapping are small areas of Gates and Valentine soils. Gates soils are in positions on the landscape similar to those of the Hersh soil. They are finer textured than the Hersh soil. Valentine soils are in the higher landscape positions. They contain more sand than the Hersh soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil, and the available water capacity is moderate. The organic matter content is low. Runoff is slow. The water intake rate is moderately high. This soil can be easily worked.

A large acreage of this soil is used for cultivated crops. The rest supports native grasses and is used as range or hayland. Some areas that were farmed have been seeded to grass or allowed to reseed naturally.

If used for dryland farming, this soil is suited to corn, alfalfa, sorghum, and small grain. Soil blowing is a hazard. A system of conservation tillage, such as disking or chiseling, that keeps crop residue on the surface helps to control soil blowing and conserves moisture. A cropping system that includes legumes, grasses, or a legume-grass mixture helps to increase the content of organic matter and improves fertility. A cropping system in which row crops are alternated with small grain, grasses, and legumes helps to control soil blowing.

If irrigated, this soil is suited to corn, alfalfa, small grain, sorghum, and introduced grasses. Water can be applied by sprinkler or gravity irrigation systems. Land leveling may be needed if a gravity system is used. Deep cuts should be avoided because they can expose the sandy underlying material. Soil blowing is a slight hazard. Returning crop residue to the soil and applying a system of conservation tillage, such as chiseling or disking, help to control soil blowing, increase the content of organic matter, and improve fertility. Keeping cover crops or crop residue on the surface helps to control soil blowing.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Continuous heavy grazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. Overgrazing also can result in severe soil blowing. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Insufficient seasonal rainfall and soil blowing are management concerns. Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Cultivation should be restricted to the tree rows. Irrigation can provide supplemental moisture during dry periods. Weeds and undesirable grasses in the tree rows can be controlled by cultivating with conventional equipment and by timely applications of the appropriate herbicides.

This soil generally is suited to septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-8, irrigated; Sandy range site; windbreak suitability group 5.

HeC—Hersh fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on side slopes in the uplands. It formed in mixed loamy and sandy eolian material. Areas range from 20 to more than 300 acres in size.

Typically, the surface layer is light brownish gray, very friable fine sandy loam about 6 inches thick. The transition layer is light brownish gray, very friable fine sandy loam about 10 inches thick. The underlying material to a depth 60 inches or more is very pale brown. The upper part is loamy very fine sand, and the lower part is loamy fine sand. In some places the dark surface layer is more than 7 inches thick. In other places the surface layer is silt loam, very fine sandy loam, or loamy fine sand.

Included with this soil in mapping are small areas of Gates and Valentine soils. Gates soils are in landscape positions similar to those of the Hersh soil. They contain less sand than the Hersh soil. Valentine soils are in the higher landscape positions. They contain more sand than the Hersh soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil, and the available water capacity is moderate. The

content of organic matter is low. Runoff is slow or medium. The water intake rate is moderately high. This soil can be easily worked.

Most of the acreage of this soil is used as cropland. The rest supports native grasses and is used as range or hayland. Some small areas that formerly were farmed have been reseeded to grass.

If used for dryland farming, this soil is suited to corn, alfalfa, small grain, and sorghum. Water erosion and soil blowing are hazards. Insufficient rainfall is a management concern. Water erosion and soil blowing can be controlled by a conservation tillage system that keeps the crop residue on the surface. Conservation tillage also helps to conserve moisture. Terraces and contour farming help to control water erosion. A cropping system that includes legumes, grasses, or grass-legume mixtures help to increase the content of organic matter and maintain fertility. A cropping system in which row crops are alternated with small grain, grasses, and legumes can help to control water erosion.

If irrigated, this soil is suited to corn, alfalfa, sorghum, and introduced grasses. A sprinkler system is the best method of irrigation. Land leveling is needed if a gravity system is used. Keeping cover crops or crop residue on the surface helps to control soil blowing and water erosion. Returning crop residue to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Continuous heavy grazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. Overgrazing also can result in severe water erosion and soil blowing. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and water erosion are severe hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Planting the trees on the contour and terracing help to control runoff and water erosion. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Weeds and undesirable grasses, which compete with the trees for moisture, can be controlled by cultivating with conventional equipment and by timely applications of the appropriate herbicides.

This soil generally is suited to use as a site for septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIIe-8, irrigated; Sandy range site; windbreak suitability group 5.

HeD—Hersh fine sandy loam, 6 to 11 percent slopes. This deep, strongly sloping, well drained soil is on side slopes and along sides of drainageways in the uplands. It formed in mixed loamy and sandy eolian material. Areas range from 10 to 200 acres in size.

Typically, the surface layer is light brownish gray, very friable fine sandy loam about 6 inches thick. The transition layer is light gray, very friable fine sandy loam about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray. The upper part is loamy very fine sand, and the lower part is loamy fine sand that has layers of loamy very fine sand and fine sandy loam. In some areas the surface layer is silt loam, very fine sandy loam, or loamy fine sand. In a few areas the dark surface layer is more than 7 inches thick.

Included with this soil in mapping are small areas of Gates and Valentine soils. Gates soils are in positions on the landscape similar to those of the Hersh soil. They contain less sand than the Hersh soil. Valentine soils are in the slightly higher areas. They contain more sand than the Hersh soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil, and the available water capacity is moderate. The content of organic matter is low. Runoff is medium. The water intake rate is moderately high. This soil can be easily worked.

Most of the acreage of this soil supports native grasses and is used as range. A small acreage is used as cropland.

If used for dryland farming, this soil is poorly suited to cultivated crops. It is better suited to alfalfa and small grain than to row crops. Water erosion and soil blowing are severe hazards. Water erosion can be controlled by terraces, contour farming, and grassed waterways. A conservation tillage system, such as disking or chiseling, that keeps the soil covered with crops or crop

residue helps to control soil blowing and water erosion and conserves moisture. It also helps to increase the content of organic matter.

If irrigated, this soil is poorly suited to the crops commonly grown in the county. It generally is not suited to row crops because water erosion is a severe hazard. A sprinkler system is the only suitable method of irrigation. Adjusting the water application rate to the intake rate of the soil reduces the runoff rate and helps to control water erosion. Terraces, grassed waterways, and a system of conservation tillage that keeps crop residue on the surface help to control water erosion and conserve moisture.

In the areas of this soil used as range, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 80 percent or more of the total annual forage. Blue grama, switchgrass, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Areas of this soil are generally the first to be overgrazed in a pasture that includes Sands or Choppy Sands range sites. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and water erosion are severe hazards. Drought also is a hazard. Growing cover crops between the tree rows helps to control soil blowing and water erosion. Irrigation can provide the supplemental moisture needed during dry periods. Weeds and undesirable grasses that compete with the trees for moisture can be controlled by cultivating with conventional equipment and by timely applications of the appropriate herbicides. Areas near the trees can be hoed by hand or rototilled.

If this soil is used as a site for septic tank absorption fields, the slope is a limitation. Shaping the land and installing the absorption fields on the contour help to ensure that the septic system functions properly. The sides of shallow excavations can cave in unless they are shored. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage. Cutting and filling are needed to provide a suitable grade for the roads.

The land capability units are IVe-3, dryland, and IVe-8, irrigated; Sandy range site; windbreak suitability group 5.

HfB—Hersh-Gates complex, 0 to 3 percent slopes. These deep, nearly level and very gently sloping, well drained soils are in dry valleys in the sandhills. The Hersh soil formed in mixed loamy and sandy eolian material. The Gates soil formed in loess and reworked loamy material. Areas range from 5 to 100 acres in size. They are 50 to 70 percent Hersh soil and 15 to 35 percent Gates soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Hersh soil has a surface layer of grayish brown, very friable fine sandy loam about 5 inches thick. The transition layer is pale brown, very friable fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is very pale brown. It is fine sandy loam in the upper part and loamy very fine sand in the lower part. In some places the dark colored surface layer is more than 10 inches thick. In other places the surface layer is very fine sandy loam or loamy fine sand. In a few places silty material is at a depth of 40 inches or more.

Typically, the Gates soil has a surface layer of brown, very friable very fine sandy loam about 6 inches thick. The transition layer is light gray, very friable silt loam about 7 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam. In some places the surface layer is fine sandy loam or loamy fine sand. In other places the underlying material is sandy. In some areas the entire profile is noncalcareous. In other areas about 6 to 20 inches of sandy material covers the surface.

Included with these soils in mapping are small areas of Ipage and Valentine soils. These included soils contain more sand than the Hersh and Gates soils. Ipage soils are moderately well drained and are on the slightly lower parts of the landscape. Valentine soils are in the higher areas. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil and moderate in the Gates soil. The available water capacity is moderate in the Hersh soil and high in the Gates soil. The content of organic matter is low in both soils. Runoff is slow. The water intake rate is moderately high.

Most of the acreage of this unit is used as cropland. The rest supports native grasses and is used for grazing or native hay. Many areas that formerly were cropland have been reseeded to grass or allowed to reseed naturally.

If used for dryland farming, these soils are suited to corn, sorghum, small grain, and alfalfa. Soil blowing is a slight hazard in cultivated areas. A conservation tillage system, such as disking or chiseling, that keeps the soil covered with crops or crop residue helps to control soil blowing and conserves moisture. A cropping system that includes legumes, grasses, or a legume-grass mixture helps to increase the content of organic matter and improves fertility.

If irrigated, these soils are suited to corn, alfalfa, sorghum, and introduced grasses. Water can be applied by gravity and sprinkler irrigation systems. Land leveling may be needed if a gravity system is used. Deep cuts should be avoided because they can expose the sandy underlying material. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and conserves moisture. Returning crop residue to the soil helps to increase the content of organic matter and improves fertility.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing. Continuous heavy grazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. Overgrazing also can result in soil blowing. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

These soils are suited to the trees and shrubs grown as windbreaks. Soil blowing, insufficient seasonal rainfall, and the competition for moisture from weeds and grasses are the main management concerns. Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Irrigation can provide the supplemental moisture needed during dry periods. Weeds and undesirable grasses in the tree rows can be controlled by cultivating with conventional equipment and by timely applications of the appropriate herbicides. Cultivation should be restricted to the tree rows.

These soils generally are suited to use as sites for septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are temporarily shored. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-8, irrigated. The Hersh soil is in the Sandy range site and windbreak suitability group 5. The Gates soil is in the Silty range site and windbreak suitability group 3.

HfG—Hersh-Gates complex, 20 to 60 percent slopes. These deep, excessively drained, steep and very steep soils are on uplands. The Hersh soil formed in mixed loamy and sandy eolian material on the upper side slopes. The Gates soil formed in loess on the lower side slopes. Areas range from 20 to more than 600 acres in size. They are 55 to 65 percent Hersh soil and 35 to 45 percent Gates soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Hersh soil has a surface layer of grayish brown, very friable fine sandy loam about 5 inches thick. The transition layer is pale brown, very friable fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches or more is very pale brown loamy very fine sand. In some areas the surface layer is very fine sandy loam. In a few places the dark surface layer is more than 7 inches thick. In places the underlying material is loamy fine sand or fine sand.

Typically, the Gates soil has a surface layer of light brownish gray, very friable silt loam about 5 inches thick. The transition layer is pale brown, very friable silt loam about 4 inches thick. The underlying material to a depth of 60 inches or more is very pale brown and light gray silt loam. Lime is at a depth of about 28 inches. In some places the dark surface layer is more than 7 inches thick. In other places lime is at a depth of less than 12 or more than 30 inches. In a few areas the loess is exposed on nearly vertical side slopes.

Included with these soils in mapping are small areas of Hobbs and Valentine soils. Hobbs soils are lower on the landscape than the Hersh and Gates soils. They are on bottom land along narrow drainageways. Valentine soils are on the higher parts of the landscape. They contain more sand than the Hersh and Gates soils. Also included are a few strongly sloping and moderately steep areas. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil and moderate in the Gates soil. The available water capacity is moderate in the Hersh soil and high in the Gates soil. The content of organic matter is low in both soils. Runoff is rapid or very rapid.

Nearly all of the acreage supports native grasses and is used for grazing. This unit is not suited to dryland or irrigated crops because the slopes are too steep. Water erosion is a severe hazard in cultivated areas.

These soils are suited to range. The climax vegetation on the Hersh soil is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 80 percent or more of the total annual forage on this soil. Blue grama, switchgrass, and forbs make up the rest. The climax vegetation on the Gates soil is dominantly big bluestem, little bluestem, indiangrass, switchgrass, and sideoats grama. These species make up 70 percent or more of the total annual forage on this soil. Blue grama, needleandthread, sedges, and forbs make up the rest.

If the range is subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance and are replaced by western wheatgrass, needleandthread, blue grama, prairie sandreed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing can help to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. The very steep slopes make it difficult for range animals to cross areas of these soils.

These soils are generally unsuited to the trees and shrubs grown as windbreaks. The steep and very steep slopes generally restrict the use of conventional tree-planting and tillage equipment. Onsite investigation is needed to identify any small areas that are suitable for windbreaks. A few areas can be used for the shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if suitable species are hand planted or other special management is applied.

These soils generally are not suitable as sites for sanitary facilities or dwellings because of the steep and very steep slopes. Suitable alternative sites are needed. Cutting and filling are needed to provide a suitable grade for roads.

The land capability unit is VIIe-3, dryland; windbreak suitability group 10. The Hersh soil is in the Sandy range site, and the Gates soil is in the Silty range site.

HgF—Hersh-Valentine complex, 9 to 24 percent slopes. These deep, moderately steep and steep soils are on side slopes along upland drainageways. The Hersh soil is somewhat excessively drained and formed in mixed loamy and sandy eolian material. The Valentine soil is excessively drained and formed in sandy eolian material. Areas range from 40 acres to more than 500 acres in size. They are 55 to 75 percent Hersh soil and 15 to 35 percent Valentine soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Hersh soil has a surface layer of grayish brown, very friable fine sandy loam about 4 inches thick. The transition layer is light brownish gray, very friable fine sandy loam about 8 inches thick. The underlying material extends to a depth of 60 inches or more. It is very pale brown. It is loamy very fine sand in the upper part and loamy fine sand in the lower part. In some places the surface layer is loamy fine sand or very fine sandy loam. In other places the underlying material is silty.

Typically, the Valentine soil has a surface layer of dark grayish brown, very friable loamy fine sand about 6 inches thick. The transition layer is grayish brown, very friable loamy fine sand about 6 inches thick. The upper part of the underlying material is pale brown loamy fine sand. The lower part to a depth of 60 inches or more is very pale brown fine sand. In places the surface layer is fine sand or fine sandy loam. In a few areas the underlying material is silty.

Included with these soils in mapping are small areas of Coly, Hobbs, and Gates soils. These included soils contain less sand than the Hersh and Valentine soils. Gates and Coly soils formed in loess on side slopes. Hobbs soils are occasionally flooded. They formed in alluvium on bottom land. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil and rapid in the Valentine soil. The available water capacity is moderate in the Hersh soil and low in the Valentine soil. The content of organic matter is low in both soils. Runoff is rapid on the Hersh soil and slow or medium on the Valentine soil.

Nearly all of the acreage supports native grasses and is used for grazing. These soils are not suitable as cropland because of the moderately steep and steep slopes. Water erosion and soil blowing are severe

hazards unless the surface is protected by a cover of grasses.

These soils are best suited to range. The climax vegetation on the Hersh soil is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 80 percent or more of the total annual forage on this soil. Blue grama, switchgrass, and forbs make up the rest. The climax vegetation on the Valentine soil is dominantly sand bluestem, little bluestem, needleandthread, and prairie sandreed. These species make up 70 percent or more of the total annual forage on this soil. Blue grama, sand lovegrass, switchgrass, sedges, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, sand dropseed, sedges, annual grasses, and forbs on both soils. Also, sandhill muhly and hairy grama increase in abundance on the Valentine soil, and blue grama increases on the Hersh soil. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is about 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

In a few areas gullies have formed because of severe water erosion. In these areas land shaping or other mechanical practices may be needed to stabilize the site before it is reseeded.

These soils are generally unsuited to the trees and shrubs grown as windbreaks. The slope prevents the use of conventional tillage and tree-planting equipment. Some areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat and for forestation plantings if suitable species are hand planted or other special management is applied. Onsite investigation is needed to identify any small areas that are suitable for windbreaks.

These soils generally are not suitable as sites for sanitary facilities because of the slope. A suitable alternative site is needed. The sides of shallow excavations can cave in unless they are temporarily shored. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. Cutting and filling are generally needed to provide a suitable grade for roads.

The land capability unit is VIe-3, dryland; windbreak suitability group 10. The Hersh soil is in the Sandy range site, and the Valentine soil is in the Sands range site.

Hm—Hobbs silt loam, channeled. This deep, well drained soil formed in silty alluvium on bottom land along narrow drainageways. It is frequently flooded. Areas of this unit include narrow bottom land, meandering stream channels, and side slopes or escarpments. Slopes are dominantly 0 to 3 percent on the bottom land but range from 20 to about 100 percent on the side slopes. Areas are long and narrow and range from 10 to 80 acres in size.

Typically, the surface layer is stratified dark grayish brown and grayish brown, very friable silt loam about 6 inches thick. The underlying material extends to a depth of 60 inches or more. It is stratified dark grayish brown, grayish brown, and light brownish gray silt loam in the upper part and stratified grayisn brown and light gray silt loam and loam in the lower part. It has thin strata of lighter colored fine sandy loam and fine sand below a depth of 40 inches. In a few places the surface layer is fine sandy loam or fine sand. In some areas a water table is at a depth of 4 to 8 feet.

Included with this soil in mapping are small areas of Cozad and Hord soils. These soils are higher on the landscape than the Hobbs soil and are not stratified in the upper part. They make up 5 to 15 percent of the unit.

Permeability is moderate in the Hobbs soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is slow.

Most of the acreage supports native grasses, trees, and shrubs. It is used for grazing and as habitat for wildlife. This soil is not suited to dryland or irrigated crops because of the meandering stream channels, the frequent flooding, and the steep or very steep side slopes.

This soil is best suited to range. The climax vegetation is dominantly big bluestem, little bluestem, switchgrass, and western wheatgrass. These species make up 75 percent or more of the total annual forage. Sideoats grama, sedges, and forbs make up the rest. If the range is subject to continuous heavy grazing, big bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by western wheatgrass, bluegrass, sedges, and forbs. Although brief in duration, flooding causes channeling and the deposition of debris and weed seeds. To avoid soil compaction, grazing on this soil should be delayed after floods.

If the range is in excellent condition, the suggested

initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Pastures should be fenced in a manner that allows cattle to move to safe places during periods of flooding.

This soil is unsuited to the trees and shrubs grown as windbreaks because the deep channels and frequent flooding prevent the use of conventional tree-planting and tillage equipment. Some areas can be used for the shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if suitable species are hand planted or other special management is applied.

This soil is not suitable as a site for sanitary facilities or dwellings because of the frequent flooding. Alternative sites are needed. Constructing roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater. The roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarse grained base material helps to ensure better performance.

The land capability unit is VIw-7, dryland; Silty Overflow range site; windbreak suitability group 10.

Ht—Hord silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on stream terraces along the North Loup River and its tributaries. It is subject to rare flooding. It formed in mixed loess and alluvium. Areas range from 20 to more than 600 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 7 inches thick. The subsurface layer is very dark gray, very friable silt loam about 11 inches thick. The subsoil is very friable silt loam about 20 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous silt loam. In some areas the surface soil is less than 20 inches thick. In many places the entire profile is noncalcareous.

Included with this soil in mapping are small areas of Cozad and Hobbs soils. Cozad soils are in landscape positions similar to those of the Hord soil. They contain less clay in the subsoil than the Hord soil. Hobbs soils are on bottom land along drainageways. They are stratified. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Hord soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is slow. The water intake rate is moderate. This soil can be easily worked. It readily releases moisture to plants.

Nearly all of the acreage of this soil is used for irrigated crops. The rest is used for dryland crops or supports native grasses and is used as range.

If used for dryland farming, this soil is suited to corn, small grain, alfalfa, sorghum, and introduced grasses. Conserving soil moisture is a management concern in cultivated areas. Conservation tillage practices, such as no-till or till-plant, that leave crop residue on the surface help to conserve moisture and control soil blowing. Crop stubble that is left standing throughout the winter helps to trap drifting snow, which provides additional moisture. The stubble also helps to control soil blowing (fig. 9). Returning crop residue and green manure crops to the soil helps to increase the content of organic matter and improves fertility and tilth.

If irrigated, this soil is suited to corn, sorghum, alfalfa, and introduced grasses. A conservation tillage system that keeps crop residue on the surface helps to conserve moisture. Gravity and sprinkler irrigation systems are suitable. Gravity systems are more common because the proper grade for irrigation on this soil can be achieved with a minimum of land leveling. A tailwater recovery system helps to conserve water and improves the efficiency of the irrigation system.

This soil is suited to range and native hay. A cover of range plants or native hay is effective in controlling soil blowing. Continuous heavy grazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Inadequate moisture is the main management concern. The survival and growth rates of adapted species are good if competing weeds and grasses are controlled. Plant competition can be controlled by cultivating with conventional equipment and by the timely application of appropriate herbicides.

The rare flooding is a limitation if this soil is used as a site for sanitary facilities or dwellings. Septic tank absorption fields function well if they are protected from the floodwater. Constructing dwellings on raised, well compacted fill material helps to prevent the damage caused by floodwater. Roads constructed in areas of this soil should be designed so that the surface pavement and base material are thick enough to

Figure 9.—Cornstalks in an area of Hord silt loam, 0 to 1 percent slopes, trap snow and help to control soil blowing.

compensate for the low strength of the soil. Providing coarser grained base material helps to ensure better performance.

The land capability units are IIc-1, dryland, and I-6, irrigated; Silty Lowland range site; windbreak suitability group 1.

IfB—Ipage fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil is in sandhill valleys. It formed in sandy eolian and alluvial material. Areas range from 10 to more than 500 acres in size.

Typically, the surface layer is grayish brown, loose fine sand about 5 inches thick. The transition layer is light brownish gray, loose fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand. It has mottles below a depth of 34 inches. In some areas the surface layer is sand or loamy fine sand. In a few places loamy material is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Els, Tryon, and Valentine soils. Els and Tryon soils are lower on the landscape than the Ipage soil. Els soils are somewhat poorly drained, and Tryon soils are poorly drained or very poorly drained. Valentine soils are on hummocks and knolls and are excessively drained. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Ipage soil, and the available water capacity is low. The content of organic matter also is low. Runoff is slow. The water intake rate is very high. The seasonal high water table is at a depth of about 3 feet in wet years and about 6 feet in dry years.

Nearly all of the acreage supports native grasses and

is used as range or hayland. The rest is used as irrigated cropland. This soil is not suited to dryland crops because of droughtiness and the hazard of soil blowing.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. It is too sandy for gravity irrigation. Frequent, light applications of irrigation water are needed to minimize the leaching of plant nutrients. Keeping crop residue on the surface helps to control soil blowing. Returning crop residue to the soil and applying barnyard manure help to increase the content of organic matter and improve fertility.

In the areas of this soil used as range or hayland, the vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 75 percent or more of the total annual forage. Blue grama, indiangrass, sedges, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, indiangrass, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and forbs dominate the site. Under these conditions, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The forage should be harvested for hay only every other year. During the following year, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks. It is so loose that the trees should be planted in shallow furrows dug with as little surface disturbance as possible. Young seedlings can be damaged by high winds and covered by drifting sand. Maintaining strips of sod or cover crops between the tree rows helps to control blowing.

If this soil is used as a site for septic tank absorption fields, the fields should be constructed on fill material that raises them a sufficient distance above the seasonal high water table. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations can cave in unless they are shored. Dwellings with basements can be constructed on raised, well compacted fill material, which increases the depth to the seasonal high water table. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated; Sandy Lowland range site; windbreak suitability group 7.

IhB—Ipage fine sand, terrace, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil is on stream terraces. It formed in sandy eolian and alluvial material. Areas range from 10 to more than 500 acres in size.

Typically, the surface layer is dark grayish brown, loose fine sand about 8 inches thick. The transition layer is brown, loose fine sand about 7 inches thick. The underlying material extends to a depth of 60 inches or more. It is pale brown fine sand in the upper part and white fine sand and sand in the lower part. It has mottles below a depth of 36 inches. In some areas the surface layer is sand or loamy fine sand. In a few places loamy material is below a depth of 40 inches.

Included with this soil in mapping are small areas of Boelus, Elsmere, Simeon, and Valentine soils. Boelus soils are higher on the landscape than the Ipage soil. They are loamy in the lower part of the subsoil. Elsmere soils are on the lower parts of the landscape and are somewhat poorly drained. Simeon and Valentine soils are on the higher parts and are excessively drained. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Ipage soil, and the available water capacity is low. The content of organic matter also is low. Runoff is slow. The water intake rate is very high. The seasonal high water table is at a depth of about 3.5 feet in wet years and about 6.0 feet in dry years. The water table normally drops to a depth of 6 feet or more in the summer.

Nearly all of the acreage supports native grasses and is used for grazing or native hay. The rest is used as irrigated cropland. This soil is not suited to dryland crops because of droughtiness and the hazard of soil blowing.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. A sprinkler system is the best

method of irrigation. Frequent, light applications of irrigation water are needed to minimize the leaching of plant nutrients. Keeping crop residue on the surface helps to control soil blowing. Returning crop residue to the soil and applying barnyard manure help to increase the content of organic matter and improve fertility.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly sand bluestem, switchgrass, little bluestem, prairie sandreed, and needleandthread. These species make up 65 percent or more of the total annual forage. Blue grama, indiangrass, sedges, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, indiangrass, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing can be excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Areas of this soil are generally the first to be overgrazed in a pasture that includes Sands and Choppy Sands range sites. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The forage should be harvested for hay only every other year. During the following year, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks. It is so loose that the trees should be planted in shallow furrows dug with as little surface disturbance as possible. Young seedlings can be damaged by high winds and covered by drifting sand. Irrigation can provide supplemental moisture during periods of low rainfall. Strips of sod or other vegetation between the tree rows help to control soil blowing. Weeds and undesirable grasses between the tree rows can be controlled by mowing. Plant competition in the tree rows can be controlled by rototilling, hand hoeing, and applying appropriate herbicides.

If this soil is used as a site for septic tank absorption fields, fill material is needed to raise the field a sufficient distance above the seasonal high water table. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of underground water supplies. The sides of shallow excavations can cave in unless they are shored. Dwellings with basements can be constructed on raised, well compacted fill material, which increases the depth to the seasonal high water table. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated; Sandy range site; windbreak suitability group 7.

ImB—Ipage loamy fine sand, terrace, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil is on stream terraces. It formed in sandy eolian and alluvial material. Areas range from 10 to more than 500 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 6 inches thick. The transition layer is brown, very friable loamy fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray fine sand. It has mottles below a depth of 38 inches. In places the surface layer is fine sandy loam or fine sand. In a few areas the underlying material is stratified with coarse sand and gravel. In some areas it has strata of fine sandy loam below a depth of 40 inches.

Included with this soil in mapping are small areas of Boelus, Elsmere, Simeon, and Valentine soils. Boelus soils are loamy in the lower part of the subsoil. They are higher on the landscape than the Ipage soil. Elsmere soils are on the lower parts of the landscape and are somewhat poorly drained. Simeon and Valentine soils are on the higher parts and are excessively drained. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Ipage soil, and the available water capacity is low. The content of organic matter also is low. Runoff is slow. The water intake rate is very high. Depth to the seasonal high water table ranges from about 3.5 feet in wet years to 6.0 feet in dry years. The water table normally drops below a depth of 6 feet in the summer.

Most of the acreage of this soil is used as cropland. The rest supports native grasses and is used as range or hayland.

If used for dryland farming, this soil is poorly suited

to cultivated crops. Corn, small grain, and alfalfa are commonly grown. Small grain and the first cutting of alfalfa are generally better suited than other crops because they grow and mature in the spring, when the amount of rainfall is higher. Insufficient seasonal rainfall is a management concern. Soil blowing is a serious hazard. Establishing crops is sometimes difficult because windblown sand can damage young seedlings. A cropping system that maintains a cover of crops, crop residue, or grass helps to control soil blowing, conserves moisture, and helps to maintain the content of organic matter and fertility.

If irrigated, this soil is suited to corn, alfalfa, and introduced grasses. A sprinkler system is the only suitable method of irrigation. Frequent, light applications of irrigation water are needed. Heavy applications can result in the leaching of plant nutrients below the root zone. Returning crop residue to the soil and applying barnyard manure increase the content of organic matter and improve fertility. Leaving crop residue on the surface helps to control soil blowing.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Continuous heavy grazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. Overgrazing also can result in soil blowing. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, soil blowing, and competition for moisture from grasses and weeds are management concerns. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation is needed during dry periods. Weeds and grasses can be controlled by cultivation with conventional equipment or by applications of appropriate herbicides.

If this soil is used as a site for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient distance above the seasonal high water table. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations can cave in unless they are shored. Dwellings with basements can be constructed on raised, well compacted fill material, which increases the depth to the seasonal high water table. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-5, dryland, and IVe-11, irrigated; Sandy range site; windbreak suitability group 5.

Lp—Loup fine sandy loam, 0 to 2 percent slopes. This deep, nearly level, poorly drained soil formed in sandy alluvium on bottom land. It is occasionally flooded. Areas range from 5 to 200 acres in size.

Typically, the surface layer is very dark gray, calcareous, very friable fine sandy loam about 4 inches thick. The subsurface layer is dark gray, mottled, very friable loamy fine sand about 9 inches thick. The transition layer is gray, mottled, very friable loamy fine sand about 4 inches thick. The underlying material extends to a depth of 60 inches or more. It is light gray, mottled fine sand in the upper part and white sand in the lower part. It has thin strata of coarse sand. In some areas the surface layer is loamy fine sand. In a few areas it is loam or silt loam. In low areas and drainageways, water stands on the surface for a few days in the spring and in other wet periods.

Included with this soil in mapping are small areas of Almeria and Bolent soils and Fluvaquents. Almeria soils and Fluvaquents are lower on the landscape than the Loup soil. Also, they have a thinner surface soil. Fluvaquents are covered by water during most of the growing season. Bolent soils are in the higher landscape positions and are somewhat poorly drained. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Loup soil, and the available water capacity is low. The content of organic matter is high. Runoff is very slow. The seasonal high water table is at the surface in wet years and within a depth of about 1.5 feet in dry years. The water table normally drops to a depth of about 1.5 to 3.0 feet in late summer.

This soil supports native grasses and is used as range or hayland. It is not suited to dryland or irrigated crops because it is too wet.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly big bluestem, indiangrass, prairie cordgrass, and switchgrass. These species make up 70 percent or more of the total annual forage. Plains bluegrass, northern reedgrass, sedges, rushes, and forbs make up the rest. Introduced grasses, such as reed canarygrass and creeping foxtail, also may be part of the plant community. If the range is subject to continuous heavy grazing or improperly harvested for hay, big bluestem, northern reedgrass,

prairie cordgrass, switchgrass, and indiangrass decrease in abundance and are replaced by slender wheatgrass, western wheatgrass, plains muhly, and sedges. If overgrazing or improper haying methods continue for many years, bluegrass, western wheatgrass, foxtail barley, sedges, rushes, and forbs dominate the site. When the surface is wet, overgrazing and the use of heavy machinery can cause surface compaction and the formation of mounds and ruts, which make grazing or harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing or haying, and restricted use during very wet periods helps to maintain or improve the range condition. This soil is generally the first to be overgrazed in a pasture that includes better drained, sandy soils. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

If this soil is used as hayland, mowing should be regulated so that grasses remain vigorous. After the ground is frozen, livestock can graze without damaging the meadows. They snould be removed in the spring, before the ground thaws and the water table reaches a high level.

Th s soil is suited to the trees and shrubs grown as windbreaks. The only suitable species are those that can tolerate the seasonal high water table. Establishing seedlings can be a problem during wet years. Tilling the soil and planting may not be possible until the water table drops and the soil begins to dry out. Weeds and undesirable grasses can be controlled by timely cultivation and by applications of approved herbicide.

This soil is not suitable as a site for sanitary facilities or dwellings because of the flooding and the wetness. A suitable alternative site is needed. Constructing roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater and wetness.

The land capability unit is Vw-7, dryland; Wet Subirrigated range site; windbreak suitability group 2D.

Ma—Marlake loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, very poorly drained soil is in depressions or basins on valley floors and in low areas bordering lakes. It is frequently ponded by water from a very high water table. It formed in sandy alluvium. Areas range from 5 to 50 acres in size.

Typically, the surface layer is dark gray, very friable loamy fine sand about 6 inches thick. The transition layer is light brownish gray, mottled, very friable loamy fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand. The profile is stratified with lighter or darker colored material. In places the surface layer is fine sandy loam or loam.

Included with this soil in mapping are small areas of Tryon soils. These soils are slightly higher on the landscape than the Marlake soil and have a lower seasonal high water table. Also included are a few small lakes and some areas where the soils are affected with salts and alkali. Included areas make up 5 to 10 percent of the unit.

Permeability is rapid in the Marlake soil, and the avai able water capacity is low. The content of organic matter is high. Runoff is ponded. The seasonal high water table is 2 feet above the surface in wet years and is within a depth of 1 foot in dry years. This soil is covered with water for most of the growing season.

This soil is used as wildlife habitat. It is too wet for use as cropland, hayland, or range. The vegetation that grows on this soil is coarse and is not palatable to livestock. It consists mainly of cattails, rushes, arrowheads, willows, and other water-tolerant plants.

This soil is generally unsuited to the trees and shrubs grown as windbreaks because of the wetness caused by the high water table. A few areas can be used for the trees and shrubs that enhance recreational areas and wildlife habitat if suitable species are hand planted or other special management is applied.

This soil is not suitable as a site for sanitary facilities or dwellings because of the ponding. A suitable alternative site is needed. Constructing roads on suitable, well compacted fill material, above the level of ponding and providing adequate roadside ditches and culverts help to prevent the road damage caused by ponding.

The land capability unit is VIIIw-7; windbreak suitability group 10. No range site is assigned.

Or—Ord very fine sandy loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil formed in stratified alluvium on bottom land. It is subject to rare flooding. Areas range from 10 to more than 200 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 5 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam about 5 inches thick. The transition layer is light gray, mottled, very friable very fine sandy loam about 5 inches th ck. The underlying material to a depth of 60 inches or more is light gray. It is mottled

fine sandy loam in the upper part, mottled loamy fine sand in the next part, and fine sand in the lower part. Lime is at the surface. The soil has strata of finer or coarser textured material in the lower part. In places the surface layer is loam, fine sandy loam, or loamy very fine sand. In a few areas the underlying material is silty.

Included with this soil in mapping are small areas of Bolent, Cozad, and Ipage soils. Bolent soils are in positions on the landscape similar to those of the Ord soil. They have more sand than the Ord soil. Cozad and Ipage soils are higher on the landscape than the Ord soil. Cozad soils are well drained. Ipage soils are moderately well drained. Also included are a few strongly alkaline areas. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Ord soil, and the available water capacity is moderate. The content of organic matter is moderately low. Runoff is slow. The water intake rate is moderately high. The seasonal high water table is at a depth of about 1.5 feet in wet years and about 3.5 feet in dry years.

Most of the acreage of this soil is used for dryland crops. The rest supports native grasses and is used for grazing or hay.

If used for dryland farming, this soil is suited to corn, alfalfa, sorghum, small grain, and introduced grasses. Wetness caused by the high water table can delay tillage in the spring. A conservation tillage system, such as disking or chiseling, that keeps crop residue on the surface helps to control soil blowing. Returning crop residue to the soil helps to maintain the content of organic matter and improves fertility.

If irrigated, this soil is suited to corn, sorghum, alfalfa, small grain, and introduced grasses. A sprinkler system is the best method of irrigation. Land leveling may be needed if a gravity system is used. Tiling is normally not required in irrigated areas, but the water table can be a problem in the spring and in other wet periods. Keeping crop residue on the surface helps to control soil blowing.

This soil is suited to range and native hay. Continuous heavy grazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. If the surface is wet, overgrazing can cause surface compaction and the formation of small mounds, which make grazing or harvesting for hay difficult. Proper grazing use timely deferment of grazing or haying, and restricted use during wet periods help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The only suitable species are those that can withstand the seasonal high water table. Establishing seedlings can be difficult during wet years. Tilling the soil and planting the seedlings may not be possible until the soil has begun to dry. Weeds and undesirable grasses between the tree rows can be controlled by cultivating with conventional equipment. Plant competition in the tree rows can be controlled by applications of the appropriate herbicides.

The hazard of flooding should be considered if this soil is used as a site for sanitary facilities or dwellings. Septic tank absorption fields should be constructed on fill material that raises them a sufficient distance above the seasonal high water table. This soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations can cave in unless they are shored. Constructing dwellings on raised, well compacted fill material helps to overcome the wetness caused by the high water table and helps to prevent the damage caused by floodwater. The damage to roads caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIw-4, dryland, and IIw-8, irrigated; Subirrigated range site; windbreak suitability group 2S.

Pb—Pits and dumps. This map unit occurs mainly as mounds of gravel, sand, and overburden and the adjacent pits. It is on the stream terraces and bottom land along the North Loup and Calamus Rivers. Most of the pits contain water, which is generally 5 to 10 feet below the surface of the surrounding land. Roads and loading facilities are in most areas. The sand and gravel are stockpiled for use in construction. The mounds generally support no vegetation. In areas that are no longer mined, however, some weeds and grasses have become established. Areas range from about 5 to 25 acres in size.

Typically, the material in this unit consists of sand and gravel. It has been mixed through mining activities. A soil profile has not developed.

Permeability is rapid or very rapid. The content of organic matter and natural fertility are very low. Runoff is very slow.

Most areas are commercially mined for sand and gravel. A few areas in abandoned pits are used as sites for dwellings. The water-filled pits are used as recreation areas and as habitat for wetland wildlife.

This unit is not suited to farming, range, windbreaks, or other agricultural uses. Vegetation gradually becomes established in areas that are no longer mined. Native grasses that can withstand droughty conditions and very sandy material can be seeded. A mulch of crop residue is needed to control soil blowing and conserve moisture in areas seeded to grass.

Trees that can withstand droughty conditions can be planted by hand in scattered areas. They can survive only if special management is applied after planting. A native grass cover can protect the seedlings from windblown sand. Supplemental water may be needed where trees are newly planted. In areas around dwellings, establishing grasses, trees, and shrubs is difficult because of the droughtiness, the very low fertility, and the very low content of organic matter.

The material in this unit absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of the underground water supplies. A better suited site is needed. The sides of shallow excavations can cave in unless they are temporarily shored. On sites for dwellings, raised, well compacted fill material may be needed to overcome the wetness caused by the seasonal high water table. Local roads can be constructed, but establishing vegetation is difficult unless the roadbank is topdressed with topsoil.

The land capability unit is VIIIs-8, dryland; windbreak suitability group 10. No range site is assigned.

SmB—Simeon sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, excessively drained soil is on stream terraces. It formed in sandy alluvium and outwash. Areas range from 40 to 180 acres in size.

Typically, the surface layer is grayish brown, loose sand about 6 inches thick. The transition layer is brown, loose sand about 4 inches thick. The upper part of the underlying material is pale brown and very pale brown sand. The lower part to a depth of 60 inches or more is white, stratified sand and coarse sand. The content of gravel in the underlying material is about 3 percent. In some areas the surface layer is loamy fine sand or loamy sand. In other areas it is dark and is more than 10 inches thick.

Included with this soil in mapping are small areas of Boelus, Ipage, and Valentine soils. Boelus soils are loamy in the lower part of the subsoil. They are slightly higher on the landscape than the Simeon soil. Ipage and Valentine soils are fine sand throughout. Ipage soils are moderately well drained and are in the lower areas. Valentine soils are in the higher areas. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Simeon soil. The available water capacity and the content of organic matter are low. Runoff is slow. The water intake rate is very high. Moisture is released readily to plants, but much of it is lost through deep percolation.

Most areas support native grasses and are used for grazing. A small acreage is used as irrigated cropland. This soil is not suited to dryland farming because of droughtiness and a severe hazard of soil blowing.

If irrigated, this soil is poorly suited to corn, sorghum, and alfalfa. It is not suited to gravity irrigation because of the very high water intake rate. A sprinkler system is the best method of irrigation. Frequent, light applications of water are needed to minimize the leaching of plant nutrients. Soil blowing is a serious hazard unless the surface is protected by crops or crop residue. Close-growing crops and a system of conservation tillage that keeps crop residue on the surface help to control soil blowing and conserve moisture. Adding barnyard manure improves fertility and increases the content of organic matter.

In the areas of this soil used as range, the climax vegetation is dominantly blue grama, needleandthread, prairie sandreed, sand bluestem, and clubmoss. These species make up 70 percent or more of the total annual forage. Sand dropseed, hairy grama, little bluestem, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, little bluestem, and prairie sandreed decrease in abundance and are replaced by hairy grama, blue grama, sand dropseed, needleandthread, sedges, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, clubmoss, common pricklypear, brittle pricklypear, fringed sagewort, and other forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned short period of heavy grazing during the grazing season or deferment of grazing in 2 years out of 3 helps to retain little bluestem and prairie sandreed in the plant community. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

If properly managed, a cover of range plants is very effective in controlling soil blowing. The low available water capacity is a limitation. The amount of forage produced varies, depending on the frequency and amount of seasonal rainfall. Areas of abandoned

cropland should be reseeded to a suitable grass mixture.

This soil is generally unsuited to the trees or shrubs grown as windbreaks and as plantings that enhance recreational areas or wildlife habitat. Onsite investigation may identify areas where trees and shrubs can be grown. Special management is needed in these areas.

This soil is suitable as a site for dwellings and roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations can cave in unless they are temporarily shored.

The land capability units are VIs-4, dryland, and IVs-14, irrigated; Shallow to Gravel range site; windbreak suitability group 10.

SmF—Simeon sand, 3 to 30 percent slopes. This deep, gently sloping to steep, excessively drained soil is on the terrace breaks along the North Loup and Calamus Rivers. It formed in sandy alluvium and outwash. Areas range from 10 to 80 acres in size.

Typically, the surface layer is grayish brown, loose sand about 4 inches thick. The transition layer is light brownish gray, loose sand about 3 inches thick. The underlying material extends to a depth of 60 inches or more. It is light brownish gray and white sand in the upper part and white coarse sand in the lower part. The content of gravel in the underlying material is about 10 percent. In some places the surface layer is loamy fine sand, loamy sand, or fine sand. In other places the content of gravel in the underlying material is more than 15 percent.

Included with this soil in mapping are small areas of Boelus and Valentine soils. Boelus soils are in landscape positions similar to those of the Simeon soil. They have loamy material in the lower part. Valentine soils are in the higher landscape positions. They are fine sand throughout. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Simeon soil. The available water capacity and the content of organic matter are low. Runoff is slow or medium. Rainfall is readily absorbed by this soil, but much of it is lost through deep percolation.

Most of the acreage supports native grasses and is used for grazing. This soil is not suited to dryland or irrigated crops because the slopes are too steep and erosive.

This soil is suited to range. The climax vegetation is dominantly blue grama, needleandthread, sand bluestem, prairie sandreed, and clubmoss. These species make up 70 percent or more of the total annual forage. Sand dropseed, hairy grama, little bluestem, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, little bluestem, and prairie sandreed decrease in abundance and are replaced by hairy grama, blue grama, sand dropseed, needleandthread, and sedges. If overgrazing continues for many years, hairy grama, blue grama, sedges, clubmoss, common pricklypear, brittle pricklypear, fringed sagewort, and other forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned short period of heavy grazing during the grazing season or deferment of grazing in 2 years out of 3 helps to retain little bluestem and prairie sandreed in the plant community. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

If properly managed, a cover of range plants is very effective in controlling soil blowing and water erosion. The low available water capacity is a limitation. The amount of forage produced varies, depending on the frequency and amount of seasonal rainfall. Areas of abandoned cropland should be reseeded to a suitable grass mixture.

This soil is generally unsuited to the trees and shrubs grown as windbreaks and to plantings that enhance recreation areas and wildlife habitat. The slope and the low available water capacity are severe limitations. Onsite investigation is needed to identify any small areas that are suitable for windbreaks.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the ground water supplies. Land shaping and installing the absorption field on the contour help to ensure that the system operates properly. A suitable alternative site is needed in areas where the slopes exceed 15 percent. The sides of shallow excavations can cave in unless they are shored. Dwellings should be designed so that they conform to the natural slope of the land, or the soil should be graded. Cutting and filling are needed to provide a suitable grade for roads.

The land capability unit is VIs-4, dryland; Shallow to Gravel range site; windbreak suitability group 10.

To—Tryon loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, poorly drained soil is in sandhill valleys. It is subject to rare flooding. It formed in sandy eolian and alluvial material. Areas range from 20 to more than 500 acres in size.

Typically, the surface layer is dark gray, very friable loamy fine sand about 5 inches thick. The transition layer is light brownish gray, mottled loose fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is mottled fine sand. It is very pale brown in the upper part and light gray in the lower part. In some of the low areas and drainageways, water stands on the surface for a few days in the spring and in other wet periods.

Included with this soil in mapping are small areas of Els and Marlake soils. Els soils are higher on the landscape than the Tryon soil and are somewhat poorly drained. Marlake soils are in the lower areas and are covered by water during most of the growing season. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Tryon soil, and the available water capacity is low. The content of organic matter is high. Runoff is very slow. The seasonal high water table is at the surface in wet years and is within a depth of about 1.5 feet in dry years.

Nearly all of the acreage supports native grasses and is used for grazing or hay. This soil is too wet for use as crop and.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly big bluestem, indiangrass, prairie cordgrass, and switchgrass. These species make up 60 percent or more of the total annual forage. Plains bluegrass, slender wheatgrass, sedges, forbs, and rushes make up the rest. Introduced grasses, such as timothy, redtop, and creeping foxtail also may be part of the plant community. If the range is subject to continuous heavy grazing or improperly harvested for hay, big bluestem, prairie cordgrass, switchgrass, and indiangrass decrease in abundance and are replaced by slender wheatgrass, western wheatgrass, plains muhly, and sedges. Timothy, redtop, and clover also increase. If overgrazing or improper haying continues for many years, bluegrass, western wheatgrass, foxtail barley, sedges, rushes, and forbs dominate the site. When the surface is wet, overgrazing and the use of heavy machinery cause surface compaction and the formation of small mounds and ruts, which hinder grazing and haying.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods helps to maintain or improve the range condition. This soil is generally the first to be overgrazed in a pasture that includes better drained, sandy soils. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be changed in successive years. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in the spring, before the ground thaws and the water table reaches a high level.

This soil is suited to the trees and shrubs grown as windbreaks. The only suitable species are those that can withstand a high water table. Tilling the soil and planting the trees in the spring may not be possible until the water table drops and the soil begins to dry out. Weeds and undesirable grasses can be controlled by cultivating with conventional equipment when the water table is at its lowest level.

This soil is not suitable as a site for sanitary facilities or dwellings because of the wetness and the flooding. A suitable alternative site is needed. The sides of shallow excavations can cave in unless they are shored. The shoring should be done during a dry period. Constructing roads on suitable, well compacted fill material and providing adequate roadside ditches and culverts help to prevent road damage caused by wetness.

The land capability unit is Vw-7, dryland; Wet Subirrigated range site; windbreak suitability group 2D.

Tp—Tryon loamy fine sand, wet, 0 to 2 percent slopes. This deep, nearly level, very poorly drained soil formed in sandy eolian and alluvial material on valley floors in the sandhills. It is subject to rare flooding and is commonly ponded by water from a very high water table in the spring and in other wet periods. Areas range from 10 to 500 acres in size.

Typically, the surface layer is dark gray, very friable loamy fine sand about 5 inches thick. The transition layer is light gray, mottled, very friable fine sand about 7 inches thick. The underlying material to a depth of more than 60 inches is light gray, mottled fine sand. In some places the surface layer is fine sand. In other places the soil is dark to a depth of 10 inches or more.

Included with this soil in mapping are small areas of Els and Marlake soils. Els soils are slightly higher on the landscape than the Tryon soil and are somewhat

poorly drained. Marlake soils are lower on the landscape than the Tryon soil and are wet for longer periods. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Tryon soil, and the available water capacity is low. The content of organic matter is high. Runoff is very slow or ponded. The seasonal high water table ranges from 0.5 foot above the surface in wet years to about 1.0 foot below the surface in dry years. The soil can be ponded for a week or more during wet periods.

Most of the acreage is range that is grazed or harvested for hay. This soil is too wet for cultivation. In the areas used as range, the climax vegetation is dominantly prairie cordgrass, bluejoint reedgrass, and northern reedgrass. These species make up 60 percent or more of the total annual forage. Slender wheatgrass, sedges, rushes, and forbs make up the rest. Introduced grasses, such as reed canarygrass and creeping foxtail, may be part of the plant community in areas managed as hayland. If the range is subject to continuous heavy grazing or improperly harvested for hay, prairie cordgrass, bluejoint reedgrass, northern reedgrass, and reed canarygrass decrease in abundance and are replaced by slender wheatgrass, plains bluegrass, green muhly, sedges, rushes, and forbs. If overgrazing or improper haying methods continue for many years, bluegrass, foxtail barley, sedges, rushes, and forbs dominate the site. When the surface is wet, overgrazing and the use of heavy machinery can cause surface compaction and the formation of small mounds and ruts, which hinder grazing and haying.

In most areas the range is in good range condition. The suggested initial stocking rate is about 1.5 animal unit months per acre. This soil generally is grazed in fall and winter, but it is not grazed during the growing season. It can produce a high quantity of forage, but the quality is low. Proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods help to keep the range in good condition.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The hay grown on this soil, however, is rather coarse. Interseeding suitable, early maturing, cool-season grasses can improve the quality of the hay where soil conditions allow early cutting. In some years the forage cannot be harvested because of the wetness. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before frost leaves the ground in the spring and the water table reaches a high level.

Because of the seasonal high water table, this soil is unsuited to the trees and shrubs grown as windbreaks. A few areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat or for forestation plantings if suitable species are hand planted or other special management is applied.

This soil is not suitable as a site for sanitary facilities or dwellings because of the ponding and the flooding. A suitable alternative site is needed. Constructing roads on suitable, well compacted fill material above the level of ponding and providing adequate roadside ditches and culverts help to prevent the road damage caused by ponding.

The land capability unit is Vw-7, dryland; Wetland range site; windbreak suitability group 10.

TsB—Tryon-Els loamy fine sands, 0 to 2 percent slopes. These deep, nearly level soils are in sandhill valleys. They are subject to rare flooding. They formed in sandy eolian and alluvial material. The poorly drained Tryon soil is in swales. The somewhat poorly drained Els soil is in the slightly higher areas. Areas of this unit range from 40 to more than 500 acres in size. They are 50 to 65 percent Tryon soil and 30 to 45 percent Els soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Tryon soil has a surface layer of dark gray, very friable loamy fine sand about 5 inches thick. The transition layer is gray, mottled, very friable loamy fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand. In some areas the surface layer is fine sandy loam or loamy sand. In places the surface soil is more than 10 inches thick. In some of the low areas and drainageways, water stands on the surface for a few days in the spring and in other wet periods.

Typically, the Els soil has a surface layer of dark gray, very friable loamy fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is mottled fine sand. It is light brownish gray in the upper part and white in the lower part. In some places the surface layer is loamy sand or sandy loam. In other places the surface soil is more than 10 inches thick.

Included with these soils in mapping are small areas of Ipage and Marlake soils. Ipage soils are higher on the landscape than the Tryon and Els soils and are moderately well drained. Marlake soils are lower on the landscape than the Tryon soil and are wet for longer periods. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Tryon and Els soils, and the available water capacity is low. The content of organic matter is high in the Tryon soil and moderately

low in the Els soil. Runoff is very slow on the Tryon soil and slow on the Els soil. The seasonal high water table in the Tryon soil is at the surface in wet years and is within a depth of about 1.5 feet in dry years. The seasonal high water table in the Els soil is at a depth of about 1.5 feet in wet years and 3.0 feet in dry years.

Most of the acreage supports native grasses and is used as range or hayland. This unit is not suitable for use as cropland because the Tryon soil is too wet.

In the areas of this unit used as range or hayland, the climax vegetation on the Tryon soil is dominantly big bluestem, switchgrass, prairie cordgrass, and indiangrass. These species make up 60 percent or more of the total annual forage on this soil. Plains bluegrass, slender wheatgrass, sedges, rushes, and forbs make up the rest. The climax vegetation on the Els soil is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up 85 percent or more of the total annual forage on this soil. Prairie cordgrass, sedges, and forbs make up the rest.

If the range is subject to continuous heavy grazing or improperly harvested for hay, big bluestem, prairie cordgrass, switchgrass, and indiangrass decrease in abundance on the Tryon soil and are replaced by slender wheatgrass, western wheatgrass, plains muhly, and sedges. Big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance on the Els soil and are replaced by sideoats grama, western wheatgrass, bluegrass, foxtail barley, green muhly, sedges, and rushes. If overgrazing continues for many years, bluegrass, western wheatgrass, foxtail barley, purple lovegrass, clover, sedges, rushes, and weeds dominate the site. During wet periods overgrazing and the use of heavy machinery can cause surface compaction and the formation of small mounds and ruts, which make grazing or harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre on the Tryon soil and 1.7 animal unit months per acre on the Els soil. The stocking rate is determined by the percentage of each soil in the pasture. A planned grazing system that includes proper grazing use, timely deferment of grazing or haying, and restricted use during very wet periods helps to maintain or improve the range condition.

If these soils are used as hayland, mowing should be regulated so that the grasses remain vigorous. Large meadows can be divided into three sections and the sections mowed in rotation. The order in which they are mowed should be changed each year. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in the spring, before the ground thaws and the water table in the Tryon soil reaches a high level.

These soils are suited to the trees and shrubs grown as windbreaks. Onsite investigation is needed to identify the best suited areas. The only suitable species are those that can withstand the high water table. Establishing seedlings can be difficult during wet years. Tilling of the soil and planting the trees may not be possible until the water table drops and the soil begins to dry out. Weeds and undesirable grasses can be controlled by cultivating with conventional equipment and by timely applications of approved herbicide.

The Tryon soil is not suitable as a site for sanitary facilities or dwellings because of the wetness and the flooding. In areas of the Els soil, septic tank absorption fields should be constructed on fill material that raises them a sufficient distance above the seasonal high water table. This soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations in these soils can cave in unless they are shored. The shoring should be done during a dry period. Constructing dwellings on raised, well compacted fill material helps to overcome the wetness caused by the high water table in the Els soil. Constructing roads on suitable, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater and wetness. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the roads by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability unit is Vw-7, dryland. The Tryon soil is in the Wet Subirrigated range site and windbreak suitability group 2D. The Els soil is in the Subirrigated range site and windbreak suitability group 2S.

TtB—Tryon-Ipage complex, 0 to 3 percent slopes. These deep soils are in sandhill valleys. They formed in sandy eolian material and sandy alluvium. The nearly level, poorly drained Tryon soil is in swales. It is subject to rare flooding. The very gently sloping, moderately well drained Ipage soil is on low ridges. Areas range from 10 to 100 acres in size. They are 50 to 65 percent Tryon soil and 25 to 40 percent Ipage soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Tryon soil has a surface layer of dark gray, very friable loamy fine sand about 4 inches thick.

The transition layer is grayish brown, mottled, loose fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray and light brownish gray, mottled fine sand. In some areas the surface layer is fine sandy loam or sandy loam. In other areas the surface soil is more than 10 inches thick. In low areas water stands on the surface for a few days in the spring and in other wet periods.

Typically, the Ipage soil has a surface layer of grayish brown, loose fine sand about 6 inches thick. The transition layer is light brownish gray, loose fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is pale brown and very pale brown fine sand. It has mottles below a depth of 34 inches. In some areas the surface layer is loamy fine sand or loamy sand. In a few areas the surface soil is more than 10 inches thick.

Included with these soils in mapping are small areas of Els, Marlake, and Valentine soils. Els soils are between the Tryon and Ipage soils on the landscape. They are somewhat poorly drained. Marlake soils are in the lowest positions on the landscape and are wet for longer periods than the Tryon and Ipage soils. Valentine soils are in the higher positions on the landscape and are excessively drained. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Tryon and Ipage soils, and the available water capacity is low. The content of organic matter is high in the Tryon soil and low in the Ipage soil. Runoff is very slow on the Tryon soil and slow on the Ipage soil. The seasonal high water table in the Tryon soil is at the surface in wet years and is within a depth of 1.5 feet in dry years. The seasonal high water table in the Ipage soil is at a depth of about 3.0 feet in wet years and 6.0 feet in dry years.

Most of the acreage supports native grasses and is used as range or hayland. This unit is not suitable for use as cropland because the Tryon soil is too wet and soil blowing is a hazard on the Ipage soil.

In the areas used as range or hayland, the climax vegetation on the Tryon soil is dominantly big bluestem, switchgrass, prairie cordgrass, and indiangrass. These species make up 60 percent or more of the total annual forage on this soil. Plains bluegrass, slender wheatgrass, sedges, and forbs make up the rest. The climax vegetation on the Ipage soil is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 75 percent or more of the total annual forage on this soil. Blue grama, sedges, indiangrass, prairie junegrass, bluegrass, and forbs make up the rest.

If the range is subject to continuous heavy grazing or improperly harvested for hay, big bluestem, prairie cordgrass, switchgrass, and indiangrass decrease in abundance on the Tryon soil and are replaced by slender wheatgrass, western wheatgrass, plains muhly, and sedges. Sand bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance on the Ipage soil and are replaced by prairie sandreed, needleandthread, blue grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, bluegrass, western wheatgrass, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and weeds dominate the site. When the surface of the Tryon soil is wet, overgrazing and the use of heavy machinery can cause surface compaction and the formation of small mounds and ruts, which make grazing or harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre on the Tryon soil and 1.0 animal unit month per acre on the Ipage soil. The stocking rate is determined by the percentage of each soil in the pasture. A planned grazing system that includes proper grazing use, timely deferment of grazing or haying, and restricted use during very wet periods helps to maintain or improve the range condition.

If these soils are used as hayland, mowing should be regulated so that the grasses remain vigorous. Mowing should be done just before the dominant grasses reach the boot stage and should be avoided between the boot stage and seed maturity. Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be changed in successive years. On the Ipage soil hay should be harvested only every other year. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in the spring, before the ground thaws and the water table in the Tryon soil reaches a high level.

These soils are suited to the trees and shrubs grown as windbreaks. Onsite investigation is needed to identify the best suited areas. The only suitable species on the Tryon soil are those that can withstand a high water table. Establishing seedlings can be difficult during wet years. Tilling the soil and planting the trees may not be possible until the water table drops and the soil begins to dry out. The Ipage soil is so loose that the trees should be planted in shallow furrows dug with as little surface disturbance as possible. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. Young seedlings can be damaged by high winds and covered by drifting sand. Weeds and undesirable grasses can be controlled by timely

cultivation with conventional equipment or by applications of approved herbicide.

The Tryon soil is generally not suitable as a site for sanitary facilities or dwellings because of the wetness and the flooding. A suitable alternative site is needed. The Ipage soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations in these soils can cave in unless they are shored. The shoring should be done during a dry period. Dwellings with basements can be constructed on the Ipage soil. They should be built on raised, well compacted fill material, which can increase the depth to the seasonal high water table. Constructing roads on suitable, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by wetness in the Tryon soil. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability unit is Vw-7, dryland. The Tryon soil is in the Wet Subirrigated range site and windbreak suitability group 2D. The Ipage soil is in the Sandy Lowland range site and windbreak suitability group 7.

UbD2—Uly silt loam, 6 to 11 percent slopes, eroded. This deep, strongly sloping, well drained soil is on side slopes and ridgetops in the uplands. It formed in loess. The original surface layer has been partially or completely removed by water erosion. In some areas tillage has mixed the remaining surface layer with the upper part of the subsoil. Areas range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 6 inches thick. The subsoil is light brownish gray, very friable silt loam about 15 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam. In places the surface layer is silty clay loam. In some areas, the upper layers have been removed by erosion and the calcareous underlying material is exposed. In areas of native grass, the surface layer is thicker and darker.

Included with this soil in mapping are small areas of Coly and Hobbs soils. Coly soils are in landscape positions similar to those of the Uly soil. They are calcareous at the surface. Hobbs soils are on bottom land along drainageways. They are stratified. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Uly soil, and the available water capacity is high. The organic matter content is moderately low. Runoff is medium. The water intake rate is moderate.

Most of the acreage of this soil is farmed. Some areas that formerly were farmed have been reseeded to native or introduced grasses and are used as range or hayland.

If used for dryland farming, this soil is poorly suited to corn, sorghum, wheat, and alfalfa. Water erosion is a severe hazard. Terraces, contour farming, and a conservation tillage system that keeps crop residue on the surface help to control water erosion. Returning crop residue to the soil and applying barnyard manure help to increase the content of organic matter and improve fertility and tilth.

If irrigated, this soil is poorly suited to alfalfa, sorghum, introduced grasses, and corn. A sprinkler system is the best method of irrigation. Application of irrigation water is critical on this soil. If center-pivot irrigation systems are used, erosion and the formation of small gullies can be problems in the wheel tracks. Adjusting the application rate to the moderate intake rate of the soil allows most of the water to be absorbed and helps to reduce the runoff rate. Water erosion is a severe hazard. Terraces, contour farming, and conservation tillage practices that leave crop residue on the surface help to control erosion. Including close-growing crops, such as alfalfa, in the cropping sequence helps to control erosion. Returning crop residue to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. It also can result in water erosion and soil blowing. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded cropland.

This soil is suited to the trees and shrubs grown as windbreaks. Water erosion is a severe hazard. Planting the trees on the contour and terracing help to control erosion. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by applications of approved herbicide.

If this soil is used as a site for septic tank absorption fields, the slope is a limitation. Installing the absorption

fields on the contour helps to ensure that the system operates properly. Dwellings should be designed so that they conform to the natural slope of the land, or the soil should be graded. Roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarse grained base material helps to ensure better performance.

The land capability units are IVe-8, dryland, and IVe-6, irrigated; Silty range site; windbreak suitability group 3.

UbE—Uly silt loam, 11 to 17 percent slopes. This deep, moderately steep, well drained soil is on ridgetops and side slopes in the uplands. It formed in loess. Areas range from 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 12 inches thick. The subsoil is very friable silt loam about 22 inches thick. It is grayish brown in the upper part and light brownish gray in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam. In some areas the surface soil is more than 20 inches thick. In other areas the surface layer is very fine sandy loam. In places lime is below a depth of 40 inches.

Included with this soil in mapping are small areas of Coly and Hobbs soils. Coly soils are in positions on the landscape similar to those of the Uly soil. They have carbonates at the surface. Hobbs soils are on bottom land along drainageways. They are stratified. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Uly soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is rapid.

Nearly all of the acreage supports native grasses and is used for grazing. A few areas are used as hayland. Most areas that formerly were farmed have been reseeded to grass or allowed to reseed naturally. This soil is not suited to dryland or irrigated crops because of the slope and a severe hazard of water erosion.

In the areas of this soil used as range, the climax vegetation is dominantly big bluestem, little bluestem, sideoats grama, blue grama, and western wheatgrass. These species make up 80 percent or more of the total annual forage. Needleandthread, tall dropseed, sedges, annual grasses, and forbs make up the rest. If the range is subject to continuous heavy grazing, big bluestem and little bluestem decrease in abundance and are replaced by blue grama, needleandthread, plains muhly, tall dropseed, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is seeded. In some areas brush control is needed.

This soil is suited to the trees and shrubs grown as windbreaks. Water erosion and drought are the main hazards. Planting the trees on the contour and terracing help to control water erosion. Supplemental water can be provided by irrigation during dry periods. Weeds and undesirable grasses, which compete with the trees for moisture, can be controlled by cultivation with conventional equipment or by timely applications of approved herbicide.

If this soil is used as a site for septic tank absorption fields, the slope is a limitation. Land shaping and installing the absorption field on the contour help to ensure that the system operates properly. Dwellings should be designed so that they conform to the natural slope of the land, or the soil should be graded. Roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarse grained base material helps to ensure better performance. Cutting and filling are needed to provide a suitable gradient for the roads.

The land capability unit is VIe-1, dryland; Silty range site; windbreak suitability group 3.

VaD—Valentine fine sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, excessively drained soil is on hummocky dunes in the uplands. It formed in sandy eolian material. The slopes are complex. Areas range from 20 to 500 acres in size.

Typically, the surface layer is grayish brown, loose fine sand about 6 inches thick. The transition layer is pale brown, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. In some places the surface layer is loamy fine sand, loamy sand, or sand. In other

places the surface soil is more than 9 inches thick.

Included with this soil in mapping are small areas of Els, Hersh, and Ipage soils. These soils are lower on the landscape than the Valentine soil. Els soils are somewhat poorly drained. Hersh soils contain less sand than the Valentine soil. Ipage soils are moderately well drained. Also included are areas where small blowouts are common and a few small areas where the slope is less than 3 or more than 9 percent. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Valentine soil, and the available water capacity is low. The content of organic matter also is low. Runoff is slow. The water intake rate is very high.

Most of the acreage supports native grasses and is used for grazing and hay. A few areas are used for irrigated crops. This soil is not suited to dryland crops because of droughtiness and the hazard of soil blowing.

If irrigated, this soil is poorly suited to corn, alfalfa, small grain, and introduced grasses. It is too sandy for gravity irrigation systems. A sprinkler system is the best method of irrigation. Frequent, light applications of water are needed to minimize the leaching of plant nutrients. Soil blowing is a severe hazard. Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves moisture. Adding barnyard manure helps to increase the content of organic matter and improves fertility.

In the areas of this soil used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage. Blue grama, switchgrass, sand lovegrass, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, sandhill muhly, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is about 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. Shaping, seeding, and mulching hasten the reclamation of blowouts.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks. It is so loose, however, that the trees should be planted in shallow furrows dug with as little surface disturbance as possible. Young seedlings can be damaged by high winds and covered by drifting sand. Maintaining strips of sod or cover crops between the tree rows help to control soil blowing. Irrigation can provide supplemental moisture during dry periods. Weeds and undesirable grasses, which compete with the trees for moisture, can be controlled by cultivating with conventional equipment and by applications of approved herbicide.

This soil generally is suitable as a site for dwellings and roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations can cave in unless they are temporarily shored. Buildings should be designed so that they conform to the natural slope of the land, or the soil should be graded.

The land capability units are VIe-5, dryland, and IVe-12, irrigated; Sands range site; windbreak suitability group 7.

VaE—Valentine fine sand, rolling. This deep, excessively drained soil is on dunes in the sandhills. It formed in sandy eolian material. Slopes generally range from 9 to 24 percent. Areas range from 40 to more than 1,000 acres in size.

Typically, the surface layer is grayish brown, loose fine sand about 4 inches thick. The transition layer is pale brown, loose fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. In places the surface layer is loamy fine sand, loamy sand, or sand.

Included with this soil in mapping are small areas of Els, Gates, Hersh, Ipage, and Tryon soils. These soils are lower on the landscape than the Valentine soil. Els and Tryon soils have a seasonal high water table. Gates and Hersh soils are finer textured than the Valentine soil. Ipage soils are moderately well drained. Also included are areas where small blowouts are common and a few small areas where the slope is more

than 24 percent. Included soils make up about 15 percent of the unit.

Permeability is rapid in the Valentine soil, and the available water capacity is low. The content of organic matter also is low. Runoff is slow or medium.

Most areas support native grasses and are used for grazing. Some areas are used for hay. This soil is unsuitable for cropland because it is too droughty and too steep.

In the areas used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage. Blue grama, switchgrass, sand lovegrass, sedges, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, sandhill muhly, annual grasses, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. Under these conditions, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is about 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Livestock tend to overuse the less sloping areas and the areas near watering facilities, roads, and trails. The steeper slopes and the areas away from the watering facilities may be underused. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture. Shaping, seeding, and mulching hasten the reclamation of blowouts.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

This soil is suited to the trees and shrubs grown as windbreaks. It is so loose, however, that the trees should be planted in shallow furrows with as little surface disturbance as possible. Young seedings can be damaged by windblown sand during periods of high winds. Strips of sod or other vegetation between the tree rows help to control soil blowing. Supplemental water is needed during dry periods. Weeds and undesirable grasses can be hoed by hand or rototilled. Also, they can be controlled by applications of appropriate herbicides.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. Land shaping and installing the distribution lines on the contour help to ensure that the absorption field functions properly. The sides of shallow excavations can cave in unless they are temporarily shored. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. Cutting and filling are generally needed to provide a suitable grade for local roads.

The land capability unit is VIe-5, dryland; Sands range site; windbreak suitability group 7.

VaF—Valentine fine sand, rolling and hilly. This deep, excessively drained soil is on dunes in the sandhills. It formed in sandy eolian material. The hilly areas are very steep and generally are higher than the rolling areas. The side slopes in most of the hilly areas have catsteps (fig. 10). Slopes generally range from 9 to 45 percent. Areas range from 60 to several thousand acres in size. They are 55 to 70 percent rolling Valentine soil and 30 to 45 percent hilly Valentine soil.

Typically, the surface layer is grayish brown, loose fine sand about 4 inches thick. The transition layer is light brownish gray, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. In a few areas the surface layer is loamy fine sand.

Included with this soil in mapping are small areas of Els, Gates, Hersh, Ipage, and Tryon soils. These soils are lower on the landscape than the Valentine soil. Els and Tryon soils have a seasonal high water table. Gates and Hersh soils are finer textured than the Valentine soil. Ipage soils are moderately well drained. Also included are areas where small blowouts are common and a few small areas where the slope is less than 9 percent. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Valentine soil, and the available water capacity is low. The content of organic matter also is low. Runoff is slow or medium.

Most areas support native grasses and are used as range. This soil is unsuitable for cropland because of the steep and very steep slopes.

In the areas of this soil used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species

Figure 10.—An area of Valentine fine sand, rolling and hilly. The catsteps are characteristic of the hilly part of this unit.

make up 65 percent or more of the total annual forage. Sand lovegrass, switchgrass, blue grama, sandhill muhly, annual grasses, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, little bluestem, sand lovegrass, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, hairy grama, sand dropseed, sandhill muhly, sedges, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is about 0.8 animal unit month per acre in the rolling areas and about 0.7 animal unit month per acre in the hilly areas. The stocking rate should be determined by onsite evaluation. It varies, depending on the percentage of the rolling areas and the percentage of the hilly areas in each pasture. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of livestock. Livestock cannot easily cross the very steep slopes. Shaping, seeding, and mulching hasten the reclamation of blowouts.

This soil is generally unsuited to the trees and shrubs grown as windbreaks. Onsite investigation is needed to

identify any small areas that are suitable for windbreaks. Some areas can be used for the trees and shrubs that enhance recreation areas or wildlife habitat if water-tolerant species are planted by hand or other special management is applied.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. Installing the distribution lines on the contour helps to ensure that the fields function properly. The sides of shallow excavations can cave in unless they are temporarily shored. Dwellings should be designed so that they conform to the natural slope of the land, or the soil should be graded. Cutting and filling are needed to provide a suitable grade for roads.

The land capability unit is VIIe-5, dryland; windbreak suitability group 10. The rolling part is in the Sands range site, and the hilly part is in the Choppy Sands range site.

VeB—Valentine loamy fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, excessively drained soil formed in sandy eolian material on uplands. Individual areas range from 40 to more than 600 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 6 inches thick. The transition layer is pale brown, very friable loamy fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. In some areas the surface layer is fine sand, loamy sand, or fine sandy loam. In places mottles are at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Gates, Hersh, and Ipage soils. These soils are lower on the landscape than the Valentine soil. Also, Gates and Hersh soils contain less sand. Ipage soils are moderately well drained. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Valentine soil. The available water capacity and the content of organic matter are low. Runoff is slow. The water intake rate is very high.

Most of the acreage of this soil supports native grasses and is used as range or hayland. The rest is used as cropland.

If used for dryland farming, this soil is poorly suited to cultivated crops. It is better suited to alfalfa and small grain than to row crops. Insufficient seasonal rainfall is a management concern. Soil blowing is a severe hazard unless the surface is protected. Windblown sand can damage or destroy young seedlings. A conservation tillage system that keeps crop residue on the surface helps to control soil blowing, conserves moisture, increases the content of organic matter, and improves fertility.

If irrigated, this soil is suited to corn, alfalfa, and introduced grasses. It is too sandy for gravity irrigation systems. A sprinkler system is the best method of irrigation. Frequent, light applications of water are needed to minimize the leaching of plant nutrients below the root zone. Soil blowing is a hazard where the surface is not adequately protected by crops or crop residue. Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves moisture. Planting rye or other winter cover crops in the fall helps to control soil blowing in areas that have been cut for silage. Applying barnyard manure helps to increase the content of organic matter and improves fertility.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, little bluestem, and blue grama. These species make up 80 percent or more of the total annual forage. Switchgrass, sand dropseed, annual grasses, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and weeds dominate the site. If the native plants lose vigor and are unable to stabilize the site, soil blowing is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of livestock. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks. Inadequate moisture and soil blowing are the main problems. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining

strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses in the tree rows can be controlled by cultivating with conventional equipment or by timely applications of approved herbicide.

This soil generally is suitable as a site for dwellings and roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The sides of shallow excavations can cave in unless they are temporarily shored.

The land capability units are IVe-5, dryland, and IVe-11, irrigated; Sandy range site; windbreak suitability group 5.

VeD—Valentine loamy fine sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, excessively drained soil is on hummocky dunes in the uplands. It formed in sandy eolian material. Areas range from 10 to 500 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 7 inches thick. The transition layer is pale brown, very friable loamy fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. In some areas the surface layer is loamy sand or fine sand. In a few places loamy material is below a depth of 20 inches. In places the surface soil is more than 9 inches thick.

Included with this soil in mapping are small areas of Gates, Hersh, and Ipage soils. These soils are lower on the landscape than the Valentine soil. Also, Gates and Hersh soils are finer textured. Ipage soils are moderately well drained. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Valentine soil. The available water capacity and the content of organic matter are low. Runoff is slow. The water intake rate is very high.

Most areas support native grasses and are used for grazing or hay. The rest are used for irrigated crops. This soil is not suited to dryland crops because of droughtiness and the hazard of soil blowing.

If irrigated, this soil is poorly suited to corn, alfalfa, introduced grasses, and small grain. It is too sandy for gravity irrigation systems. A sprinkler system is the best method of irrigation. Frequent, light applications of water are needed to minimize the leaching of plant nutrients below the root zone. Soil blowing is a severe hazard if the surface is not adequately protected by crops or crop residue. Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserve moisture. Grazing of the crop residue should be restricted. Planting rye or other winter cover crops in the fall helps to control soil blowing in areas that have been cut for silage. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing. Applying barnyard manure helps to increase the content of organic matter and improves fertility.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, little bluestem, and blue grama. These species make up 75 percent or more of the total annual forage. Switchgrass, sand lovegrass, annual grasses, and forbs make up the rest. If the range is subject to continuous heavy grazing or improperly harvested for hay, sand bluestem, little bluestem, sand lovegrass, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive.

If the range is in excellent condition, the suggested initial stocking rate is about 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas of abandoned cropland should be reseeded to a suitable grass mixture.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks. Inadequate moisture and soil blowing are the main problems. Irrigation can provide the supplemental moisture needed during dry periods. The soil is so loose that the trees should be planted in shallow furrows dug with as little surface disturbance as possible. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Young seedlings can be damaged by high winds and covered by drifting sand. Weeds and undesirable grasses can be controlled by cultivating with conventional equipment or by timely applications of the appropriate herbicides. Areas near the trees can be rototilled or hoed by hand.

This soil generally is suitable as a site for dwellings and roads. It readily absorbs but does not adequately

filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The sides of shallow excavations can cave in unless they are temporarily shored. Dwellings should be designed so that they conform to the natural slope of the land, or the soil should be graded.

The land capability units are VIe-5, dryland, and IVe-11, irrigated; Sands range site; windbreak suitability group 7.

VmD—Valentine-Els complex, 0 to 9 percent slopes. These deep soils formed in sandy eolian material in the sandhills. The excessively drained, gently sloping and strongly sloping Valentine soil is on hummocky dunes. The somewhat poorly drained, nearly level Els soil is in swales between the dunes. It is subject to rare flooding. Areas range from 40 to more than 1,000 acres in size. They are 50 to 65 percent Valentine soil and 20 to 45 percent Els soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Valentine soil has a surface layer of brown, loose fine sand about 5 inches thick. The transition layer is grayish brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand. In places the surface layer is loamy fine sand or loamy sand.

Typically, the Els soil has a surface layer of grayish brown, very friable loamy fine sand about 6 inches thick. The transition layer is light brownish gray, very friable loamy sand about 10 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled sand. In places the surface layer is fine sand or loamy sand.

Included with these soils in mapping are small areas of Ipage, Marlake, and Tryon soils. Ipage soils are between the Valentine and Els soils on the landscape. They are moderately well drained. Marlake and Tryon soils are lower on the landscape than the Els soil. Marlake soils are very poorly drained and are covered by water during most of the growing season. Tryon soils are poorly drained or very poorly drained. Also included are areas where small blowouts have formed and some small areas where the slope is more than 9 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is rapid in the Valentine and Els soils, and the available water capacity is low. The content of organic matter is low in the Valentine soil and moderately low in the Els soil. Runoff is slow on both soils. The water intake rate is very high. The seasonal high water table in the Els soil is at a depth of about 1.5 feet in wet years and about 3.0 feet in dry years.

Most of the acreage supports native grasses and is used as range or hayland. A small acreage is used as irrigated cropland. These soils are not suited to dryland crops because of droughtiness and the hazard of soil blowing.

If irrigated, these soils are poorly suited to corn, small grain, alfalfa, and introduced grasses. They are too sandy for gravity irrigation systems. A sprinkler system is the best method of irrigation because frequent, light applications of water are needed. Wetness caused by the seasonal high water table in the Els soil can be a problem in the spring and in other wet periods. During dry periods the water table can be beneficial. Soil blowing is a severe hazard if the surface is not adequately protected by crops or crop residue. Leaving the maximum amount of crop residue on the surface helps to control soil blowing and conserves moisture. Including close-growing crops, such as alfalfa and grasses, in the cropping sequence helps to control soil blowing. Adding barnyard manure helps to increase the content of organic matter and improves fertility.

In the areas used as range or hayland, the climax vegetation on the Valentine soil is dominantly sand bluestem, prairie sandreed, little bluestem, and needleandthread. These species make up 70 percent or more of the total annual forage on this soil. Sand lovegrass, blue grama, switchgrass, annual grasses, and forbs make up the rest. The climax vegetation on the Els soil is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up 85 percent or more of the total annual forage on this soil. Prairie cordgrass, sedges, annual grasses, and forbs make up the rest.

If the range is subject to continuous heavy grazing or improperly harvested for hay, sand bluestem, little bluestem, sand lovegrass, indiangrass, and switchgrass decrease in abundance on both soils. They are replaced by needleandthread, blue grama, sand dropseed, sandhill muhly, and forbs on the Valentine soil and by sideoats grama, western wheatgrass, bluegrass, foxtail barley, green muhly, sedges, and rushes on the Els soil. If overgrazing continues for many years, the native plants on the Valentine soil lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form. On the Els soil, bluegrass, purple lovegrass, sedges, rushes, and weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is about 0.8 animal unit month per acre on the Valentine soil and 1.7 animal unit months per acre on the Els soil. The stocking rate is determined

by the percentage of each soil in the pasture. The range should be closely monitored during grazing periods, and the stocking rates should be adjusted so that neither soil is overgrazed. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can help to achieve a better distribution of grazing.

Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. Shaping, seeding, and mulching hasten the reclamation of blowouts.

If these soils are used as hayland, mowing should be regulated so that the plants remain healthy and vigorous. The Valentine soil should be mowed only every other year. During the following year, the hayland should be used only as fall or winter range.

These soils are suited to the trees and shrubs grown as windbreaks. Onsite investigation is needed to identify the best suited areas. The Valentine soil is so loose that the trees should be planted in shallow furrows with as little disturbance of the surface as possible. Young seedlings may be damaged by high winds and covered by drifting sand. Strips of sod or other vegetation between the tree rows help to control soil blowing. Irrigation can provide supplemental moisture during dry periods. The only species suitable for planting on the Els soil are those that can tolerate occasional wetness. Planting trees can be difficult in wet years. Tilling the soil and planting the trees in spring may not be possible until the soil begins to dry out. Weeds and undesirable grasses, which compete with the trees for moisture, can be controlled by cultivating with conventional equipment or by timely applications of the appropriate herbicides.

These soils readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Absorption fields on the Els soil should be constructed on fill material that raises them a sufficient distance above the seasonal high water table. The sides of shallow excavations can cave in unless they are shored. The shoring should be done during a dry period on the Els soil. The Valentine soil generally is suitable as a site for dwellings and roads. Dwellings on the Els soil should be constructed on elevated, well compacted fill material, which helps overcome the wetness caused by the seasonal high water table and helps to prevent the damage caused by floodwater. Constructing roads on suitable, well compacted fill material above the level of flooding and providing adequate roadside ditches and culverts help to prevent the road damage caused by floodwater and wetness. The damage by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated. The Valentine soil is in the Sands range site and windbreak suitability group 7. The Els soil is in the Subirrigated range site and windbreak suitability group 2S.

VsD—Valentine-Simeon complex, 0 to 9 percent slopes. These soils are deep and excessively drained. The gently sloping and strongly sloping Valentine soil is on hummocky dunes. It formed in sandy eolian material. The nearly level and very gently sloping Simeon soil is on the stream terrace between the dunes. It formed in sandy alluvium and outwash. Areas range from 40 to more than 500 acres in size. They are 50 to 60 percent Valentine soil and 25 to 40 percent Simeon soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Valentine soil has a surface layer of grayish brown, loose fine sand about 4 inches thick. The transition layer is light brownish gray, loose fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand. In some areas the surface layer is loamy fine sand or fine sandy loam. In a few areas coarse sand is below a depth of 40 inches. In places the surface soil is more than 9 inches thick.

Typically, the Simeon soil has a surface layer of grayish brown, loose sand about 5 inches thick. The transition layer is brown, loose sand about 8 inches thick. The underlying material to a depth of 60 inches or more is white sand. The content of gravel in the underlying material is about 5 percent. In some areas the surface layer is loamy sand, fine sand, or sandy loam. In a few areas the surface soil is more than 9 inches thick.

Included with these soils in mapping are small areas of Boelus and Ipage soils. Boelus soils are slightly higher on the landscape than the Simeon soil. They are loamy in the lower part of the subsoil. Ipage soils are lower on the landscape than the Simeon soil and are moderately well drained. Also included are some small areas where the slope is more than 9 percent. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Valentine and Simeon soils, and the available water capacity is low. The content of organic matter also is low. Runoff is slow,

and the water intake rate is very high.

Most of the acreage supports native grasses and is used as range. Some areas are used as irrigated cropland. This unit is not suited to dryland crops because of droughtiness and the hazard of soil blowing.

If irrigated, these soils are poorly suited to small grain, corn, introduced grasses, and alfalfa. They are too sandy for gravity irrigation. A sprinkler system is the best method of irrigation because frequent, light applications of water are needed to minimize the leaching of plant nutrients. Soil blowing is a severe hazard if the surface is not protected by crops or crop residue. Growing winter cover crops, including close-growing crops in the cropping sequence, and keeping crop residue on the surface help to control soil blowing and conserve moisture. Applying barnyard manure helps to increase the content of organic matter and improves fertility.

In the areas used as range, the climax vegetation on the Valentine soil is dominantly sand bluestem, little bluestem, needleandthread, and prairie sandreed. These species make up 70 percent or more of the total annual forage on this soil. Sand lovegrass, blue grama, switchgrass, annual grasses, and forbs make up the rest. The climax vegetation on the Simeon soil is dominantly blue grama, sand bluestem, needleandthread, prairie sandreed, and clubmoss. These species make up 70 percent or more of the total annual forage on this soil. Hairy grama, little bluestem, sand dropseed, annual grasses, and forbs make up the rest. If the range is subject to continuous heavy grazing, sand bluestem, sand lovegrass, switchgrass, and little bluestem decrease in abundance on both soils. They are replaced by needleandthread, blue grama, hairy grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is about 0.8 animal unit month per acre on the Valentine soil and about 0.6 animal unit month per acre on the Simeon soil. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned short period of heavy grazing during the grazing season or deferment of grazing in 2 years out of 3 helps to retain little bluestem and prairie sandreed in the plant community on the Simeon soil. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Shaping, seeding, and mulching hasten the reclamation of blowouts.

Onsite investigation is needed to identify areas of these soils that are suitable for windbreaks. The Valentine soil is suited to the trees and shrubs grown as windbreaks, but the Simeon soil is too droughty. The Valentine soil is so loose that the trees should be planted in shallow furrows with as little disturbance of the surface as possible. Young seedlings can be damaged by high winds and covered by drifting sand. Maintaining strips of sod or cover crops between the tree rows helps to control soil blowing. Irrigation can provide supplemental moisture during dry periods. Weeds and undesirable grasses can be controlled by cultivating with conventional equipment or by applications of the appropriate herbicides.

These soils generally are suited to use as sites for dwellings and roads. They readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in pollution of the underground water supplies. The sides of shallow excavations can cave in unless they are shored.

The land capability units are VIe-5, dryland, and IVe-12, irrigated. The Valentine soil is in the Sands range site and windbreak suitability group 7. The Simeon soil is in the Shallow to Gravel range site and windbreak suitability group 10.

Vt—Vetal loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on stream terraces along the North Loup River. It formed in loamy alluvium and eolian sediments. The only area of this soil in the county is about 420 acres in size.

Typically, the surface layer is brown, very friable loam about 7 inches thick. The subsurface layer is about 23 inches thick. The upper part is dark grayish brown, very friable loam, and the lower part is grayish brown, very friable fine sandy loam. The next layer is dark gray, very friable very fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches or more is grayish brown very fine sandy loam. In some places land leveling has exposed the light colored underlying material. In other places the surface layer is silt loam or fine sandy loam. In a few areas the underlying material is calcareous.

Included with this soil in mapping are small areas of Hersh, Hord, and Valentine soils. Hersh and Valentine soils are higher on the landscape than the Vetal soil. Also, they contain more sand. Hord soils are lower on the landscape than the Vetal soil. Also, they contain less sand. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Vetal soil, and the available water capacity is high. The content of

organic matter is moderate. Runoff is slow. The water intake rate is moderate. This soil can be easily worked. It absorbs water well and readily releases moisture to plants.

Nearly all of the acreage is used as cropland. The rest supports native grasses and is used as range. Most of the cropland is irrigated.

If used for dryland farming, this soil is suited to corn, sorghum, small grain, and alfalfa. Soil blowing is a slight hazard if the surface is not protected by crops or crop residue. Insufficient seasonal rainfall limits crop production in most years. A conservation tillage system that keeps crop residue on the surface conserves moisture and helps to control soil blowing. Returning crop residue and green manure crops to the soil helps to maintain the content of organic matter and improves fertility.

If irrigated, this soil is suited to corn, sorghum, alfalfa, small grain, and introduced grasses. Water can be applied by gravity or sprinkler irrigation systems. Land leveling may be needed if a gravity system is used. Disking, chiseling, or another conservation tillage system that keeps crop residue on the surface conserves moisture and helps to control soil blowing. Returning crop residue to the soil helps to increase the content of organic matter and improves fertility.

This soil is suited to range and native hay. A cover of range plants or native hay is effective in controlling soil blowing. Overgrazing by livestock or improper haying methods reduce the extent of the protective plant cover and cause the native plants to deteriorate. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Inadequate rainfall and plant competition are the main management concerns. Irrigation can provide the supplemental water needed during periods of low rainfall. Good site preparation, timely cultivation, and timely applications of the appropriate herbicides help to control the weeds and undesirable grasses that compete with the trees for moisture.

This soil generally is suited to use as a site for septic tank absorption fields and dwellings. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIc-1, dryland, and I-6, irrigated; Silty range site; windbreak suitability group 5.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 21,930 acres in the survey area, or nearly 6 percent of the total acreage, meets the soil requirements for prime farmland. Most of the prime farmland is in the southern part of the county, mainly in associations 6 and 8, which are described under the heading "General Soil Map Units." Nearly all of the acres of this prime farmland is used for crops. The crops grown on this land are mainly corn and alfalfa.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for windbreaks and wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, cam rounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretative Groups," which follows the tables at the back of this survey.

Crops and Pasture

William E. Reinsch, conservation agronomist, and Sheila R. Valasek, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 6 percent of the acreage in Loup County is cropland. Corn and alfalfa are the main crops. The paragraphs that follow describe the management needed on the cropland in the county.

Management for Dryland Crops

Good management in areas used for dryland crops reduces the runoff rate, helps to control soil blowing and water erosion, conserves moisture, and improves tilth. Erosion is a hazard on most of the cultivated soils in the county. In many areas applying conservation practices helps to reduce this hazard.

Contour farming and a conservation tillage system that keeps crop residue on the surface help to control water erosion. They also reduce the runoff rate and increase the amount of moisture available to crops. Keeping crop residue on the surface or growing a protective plant cover minimizes surface crusting during and after heavy rains, increases the rate of water intake, and reduces the runoff rate. The crop residue

also reduces the evaporation rate by lowering the surface temperature. During winter, crop stubble traps snow, which can provide additional moisture.

Soil blowing is a major hazard in Loup County. It can be controlled by a number of conservation practices. These include leaving crop residue on the surface throughout the winter, until spring planting; a conservation tillage system that keeps crop residue on the surface after planting; wind stripcropping; and field windbreaks. The hazards of soil blowing and water erosion can be reduced if the more productive soils are used for row crops. The steeper, more erosive soils can be used for close-growing crops, such as small grain and alfalfa, or for hay and pasture.

Insufficient rainfall limits crop production in the county. A cropping system and management practices that help to prevent excessive soil loss and conserve moisture are needed on all of the cropland in the county.

Proper management practices and a suitable cropping sequence help to maintain tilth and fertility, help to maintain a plant cover that protects the soil against erosion, and control weeds, insects, and diseases. The management practices and cropping sequence vary, depending on the kind of soil. For example, a proper cropping sequence and conservation practices are needed on Hersh fine sandy loam, 3 to 6 percent slopes, to help control soil blowing and water erosion. The management practices include a conservation tillage system that leaves a high percentage of crop residue on the surface during winter and a contour stripcropping system of row crops and close-growing crops.

Conserving soil moisture is an important factor in the production of dryland crops. Conservation tillage practices, such as no-till or ridge-till systems of planting row crops, help to keep snow on the fields and reduce the evaporation rate. Planting and farming on the contour and stripcropping reduce runoff and infiltration rates.

The kind and amount of fertilizer needed in areas of dryland crops should be based on the results of soil tests and on the moisture content of the soil when the fertilizer is applied. If the soil is dry or if rainfall is below normal, the amount of nitrogen fertilizer applied should be slightly less than the recommended amount because of the carry-over of nitrogen from the previous year. Nitrogen fertilizer is beneficial on all soils used for nonlegume crops. Potassium, phosphorus, and zinc are beneficial in severely eroded areas and in areas that have been cut during the construction of terraces or during other earth-moving activities. Dryland crops generally require less fertilizer than irrigated crops because the plant population is lower.

Care is needed when a seedbed is prepared or weeds are removed through cultivation. Excessive tillage reduces the extent of the plant cover, breaks down the granular structure of the surface layer, and thus increases the hazard of soil blowing. Steps in the tillage process should be limited to those that are essential. Various conservation tillage practices can be used in the county. Examples are no-till and till-plant, which are well suited to the soils used for row crops. A seed drill can plant grasses by drilling into a cover of stubble without further seedbed preparation.

Management for Irrigated Crops

About 70 percent of cropland in Loup County is irrigated. Corn and alfalfa are the chief irrigated crops. Gravity or sprinkler irrigation can be used where corn is grown. Border, corrugation, or sprinkler irrigation can be used where alfalfa is grown. Irrigation water is obtained from both wells and canals.

Most nearly level and very gently sloping, moderately permeable soils, such as Cozad soils, are well suited to gravity irrigation. On these soils row crops dominate the cropping sequence. A cropping sequence that includes both corn and alfalfa helps to control the cycle of diseases and insects that is common if the same crop is grown year after year. On gently sloping soils, such as Gates silt loam, 3 to 6 percent slopes, eroded, water erosion is a severe hazard if furrow irrigation is used. On these soils sprinkler irrigation is better suited than furrow irrigation.

Land leveling, which allows an even distribution of water, can improve the efficiency of furrow irrigation and thus can conserve the water supply. The efficiency also can be improved by a tailwater recovery system, which traps excess irrigation water running off the field. The water can then be pumped back on the field and used again.

The amount of water applied by sprinklers can be controlled; consequently, sprinkler irrigation systems can be used for special purposes. One of these is establishing grass in moderately steep areas that formerly were cultivated. The most common sprinkler systems in Loup County are the center-pivot and towline systems.

Sprinklers can apply water at a rate that conforms to the rate of water intake of the soil. They can be used on the more sloping or sandy soils. The rate of water intake in sandy soils limits the effectiveness of gravity irrigation. A conservation tillage system that leaves crop residue on the surface after the crop is planted reduces

the evaporation rate and conserves irrigation water.

Conservation tillage also improves the intake of rainfall, reduces the runoff rate, and helps to control soil blowing and water erosion. Wind drift can result in an uneven distribution of water under some sprinkler systems. Watering at night, when wind velocities are usually lower, reduces the evaporation rate and improves water distribution.

Soil holds a limited amount of water; consequently, irrigation water is needed at regular intervals to keep the soil moist. Application rates and the frequency of irrigation vary depending on the kind of soil, the crop, and the amount of available moisture in the soil. If erosion is a hazard, the application rate should not exceed the rate of water intake of the soil.

The available water capacity varies widely in the soils in Loup County that commonly are irrigated. For example, Hord silt loam, 0 to 1 percent slopes, holds about 2.5 inches of available water per foot of soil. Thus, when planted to a crop that has roots extending to a depth of 4 feet, this soil supplies about 10 inches of available water to the crop. When planted to the same crop, sandy soils, such as Valentine loamy fine sand, supply about 4 inches of available water in 4 feet of soil. For maximum efficiency, irrigation should be begun when the plants have used about half of the available water. The irrigation system should replace water at a rate that ensures a steady water supply for the plants.

Yields are generally higher on irrigated soils than nonirrigated soils. Consequently, the plants remove more plant nutrients. Returning all crop residue to the soil and adding livestock manure and commercial fertilizer help to maintain the supply of plant nutrients. The grain crops grown in Loup County respond well to applications of nitrogen fertilizer. In areas where the surface has been disturbed by land leveling, especially where the topsoil has been removed, plants respond well to applications of phosphorus, potassium, zinc, and iron. On Ipage, Valentine, and other sandy soils, which have a low available water capacity, plant nutrients can be quickly leached below the root zone. On these soils fertilizer can be applied at frequent intervals along with the irrigation water. Carefully controlling the amount of water applied helps to prevent loss of plant nutrients. Soil tests can determine the amount and kind of fertilizer needed on specific sites.

All the soils in Nebraska are assigned to irrigation design groups. These groups are described in an irrigation guide that is part of the technical specifications for conservation in Nebraska *(8)*.

Assistance in planning and designing an irrigation system can be obtained from the local office of the Soil Conservation Service or from the Cooperative Extension Service. Estimates of the cost of irrigation equipment can be obtained from local dealers and manufacturers.

Weed Control

A proper cropping sequence can control weeds. Rotating different crops in a planned sequence not only helps to control weeds, but also increases the productivity of the soil and the content of organic matter.

Applications of herbicide also are effective in controlling weeds. The kind of soil should determine the kind and amount of herbicide to be applied. The colloidal clay and humus fractions of the soil are responsible for most of the chemical activity in the soil. Applications of an excessive amount of herbicide can damage crops on sandy soils, which have a low content of colloidal clay. They also can damage crops on soils that are low in content of organic matter. The Cooperative Extension Service can provide additional information about weed control.

Management of Pasture and Hayland

Maximum production should be the goal of hayland or pasture management. After a pasture is established, the grasses should be kept productive. In Loup County, pastures of introduced grasses consist mainly of cool-season grasses, which start to grow early in spring and reach their peak growth in May or June. These grasses are dormant during July and August and start to grow again in the fall if moisture is available. For this reason, the grasses grown in the pastured areas should include warm-season grasses or temporary stands of sudangrass. These grasses attain their peak growth during July and August. A combination of cool- and warm-season grasses provides forage during the entire growing season.

In both dryland and irrigated areas, rotation grazing allows for regrowth of grasses and legumes. A planned grazing system in which pastures of cool-season grasses are grazed in rotation extends the grazing season and increases forage production. The most commonly grown introduced grasses on cool-season pastures are smooth bromegrass and intermediate wheatgrass. Other cool-season grasses and legumes suited to the soils and climate in the county are orchardgrass, creeping foxtail, meadow bromegrass, reed canarygrass, alfalfa, birdsfoot trefoil, and cicer milkvetch. When planted as a single species on nonirrigated land, some native warm-season grasses can be grown along with the cool-season grasses.

Examples are switchgrass, indiangrass, and big bluestem. If a planned grazing system is applied, these warm-season grasses can provide high-quality forage during the summer.

Introduced pasture grasses can be grazed in the spring and fall, after they reach a height of 5 or 6 inches. Until they reach this height, they grow on food reserves stored in their roots and rhizomes. Grazing too early in spring or too late in fall reduces the vigor of the plants.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for windbreaks, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained;

w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow or droughty; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIc-1 or IIIe-9.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units," in the yields table, and in the "Interpretative Groups" section, which follows the tables at the back of this survey.

Rangeland

Kenneth L. Hladek, range conservationist, Soil Conservation Service, helped prepare this section.

About 90 percent of the acreage in Loup County is native grassland used for grazing or hay. In addition, some of the cropland in the county produces supplemental feed for livestock. Ranching is the most important agricultural enterprise in the county. Therefore, proper management of range and hayland is the most important part of the conservation program in Loup County. Good range management can improve forage yields and thus increase livestock production. This section can aid ranchers and conservationists in planning the management of range. It defines range sites, explains the evaluation of range condition, and describes planned grazing systems and other aspects of range and hayland management.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship of soils to vegetation and water.

Table 8 shows, for nearly all of the soils, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 8 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the

Figure 11.—An area of Valentine fine sand, rolling and hilly. The range on the right is in good condition, and that on the left is in poor condition.

potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Range condition is the present state of vegetation on a range site compared with the potential, or *climax vegetation*, for that site. Climax vegetation is a stable plant community. It represents the most productive combination of forage plants on a given range site. It reproduces itself naturally and changes little as long as the climate and soil conditions remain unchanged. Determining the range condition provides an approximate measure of the deterioration of the plant community. More importantly, the range condition provides a basis for predicting the degree of improvement possible under different kinds of management. Four condition classes are used to indicate the departure from the potential, or climax. They are excellent, good, fair, and poor (fig. 11).

All food that plants use for growth is manufactured in their leaves. Removal of plant leaves during the growing season affects the growth of both roots and shoots. Livestock graze selectively, removing more leaves from some plants than from others. This

selective grazing varies according to the season and the degree of range use. Plants respond to grazing in different ways. Some decrease in abundance, some increase, and others not originally part of the plant community can invade. Plant responses to grazing are used in classifying the range condition.

Decreaser species are those in the original plant community that decrease in abundance if grazed closely during the growing season. Increaser species are those in the original plant community that normally increase in abundance, at least for a time, as the decreaser plants become less abundant. Invader species are those not in the original plant community that begin to grow on a site after the decreasers and increasers have been removed or have become less extensive.

After the range condition is determined, further investigation can indicate whether the condition is improving or deteriorating. This trend affects adjustments in grazing use and management. Important factors affecting the trend are plant vigor and the capacity for reproduction of both desirable and undesirable plant species.

Excellent range condition is the goal of range management. If the range is in excellent condition, the highest sustained yields are obtained. In addition, soil blowing and water erosion are controlled without conservation practices, and maximum use is made of rainfall and snowmelt. The following paragraphs describe the management needed on the range in Loup County. The management includes proper grazing use, a planned grazing system, deferred grazing, range seeding, control of blowouts and brush, and proper haying methods.

Proper Grazing Use

Proper grazing use is grazing at an intensity that maintains enough plant cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. It is the first and most important step in successful range management. It increases the vigor and reproduction capacity of desirable plants, results in an accumulation of enough litter and mulch to control erosion, and increases forage production. The proper degree of grazing on range used during the entire growing season is the removal of half of the current year's growth.

Proper grazing use is determined by the degree to which desirable species are grazed in key areas. It is affected by stocking rates, the distribution of livestock, and the kinds and classes of livestock.

The stocking rate is the number of cattle grazing a particular pasture. It is based on animal units and animal unit months. An *animal unit* is a measurement of livestock numbers based on the equivalent of one mature cow and a 6-month-old calf. An *animal unit month* (AUM) is the forage or feed necessary to sustain an animal unit for 1 month. The range site for each map unit and the range condition are used to determine the animal unit months. The proper stocking rates for range sites in excellent condition are given for many of the soils under the heading "Detailed Soil Map Units." The rates are lower for range sites in less than excellent condition.

In an area of Valentine fine sand, rolling, the suggested initial stocking rate is about 0.8 animal unit month per acre if the range is in excellent condition. Thus, a 640-acre pasture in excellent condition can carry 512 animal units for 1 month. If the pasture is to be grazed for 5 months, then the suggested initial stocking rate would be 102 animal units. This rate is based on the existing plant community and the average annual production that each site can produce. Weather conditions can cause forage to vary. The suggested rate is intended as an initial stocking rate. It can be changed as forage production or the management system changes.

A proper distribution of livestock throughout a pasture requires planning. Livestock tend to graze most heavily in areas near livestock water and salting facilities, in the more gently sloping areas, and in areas near roads and trails. Distant corners of pastures and steep areas may be undergrazed. Poor grazing distribution can result from too few watering facilities or from poorly distributed water and salting facilities, shade, and supplemental feed. The concentration of livestock results in severe use in only parts of the pasture, leaving other parts unused. A uniform distribution of grazing is best achieved by carefully locating fences and salting and watering facilities.

Fences help to distribute grazing in a more uniform pattern. Also, they can divide pastures into sections used in a planned grazing system and can isolate blowouts and reseeded areas. Cross fences should follow natural land features and range sites as much as possible. They should be planned so that all pastures have similar potential stocking rates. Generally, the smaller pastures are managed more efficiently than the larger ones. This efficiency should be considered when the pasture size is determined.

Properly locating salting facilities is one of the easiest methods of achieving a more uniform distribution of grazing in a pasture. The salting facilities should be located away from watering facilities. Salt can be easily moved to areas that are undergrazed and can

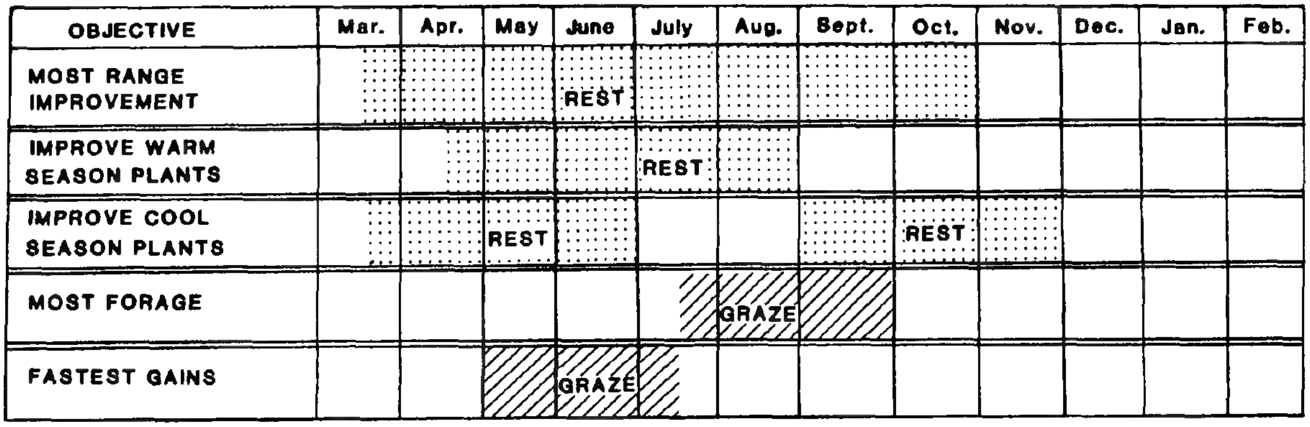

Figure 12.—Grazing and rest periods needed to achieve various objectives in areas of native range.

be relocated at different times throughout the grazing season. On Sands and Choppy Sands range sites, relocating the salting station each time that salt is provided lessens the hazard of soil blowing.

Properly located watering facilities also can improve the distribution of grazing. In Loup County, most livestock water is drawn from wells. Windmills pump the water in most of these wells. Some dugouts are on the wetter range sites, and some stockwater dams are in areas of the Coly-Uly-Hobbs and Hersh-Gates-Valentine associations in the southern part of the county. The distance between watering facilities varies, depending on the terrain. In rough or hilly areas, it should not be more than 0.5 mile. In the more level areas, it should be no more than 1 mile. If the distance is too far, the areas near water sources will be overgrazed.

The management of range is also dependent on the kinds and classes of livestock grazing the pasture. Cattle, sheep, and horses have different grazing habits and nutritional needs. Grazing habits differ among classes of cattle. Yearlings will graze the steeper areas as well as other areas. They graze a pasture more uniformly than cows with calves. They trail along fence lines, however, and can create blowout problems. Cow-calf pairs favor the gentle slopes and tend to stay closer to watering facilities. As a result, the distribution of grazing is not so uniform as that in areas grazed by yearlings.

Planned Grazing Systems

Planned grazing systems are effective in achieving the highest production and in controlling erosion and blowouts. In a planned grazing system, two or more pastures are alternately rested and grazed in a planned sequence over a period of years (fig. 12). The same pasture is not grazed during the same period 2 years in a row. As a result, plant vigor, the plant community, and the range condition are improved. The rest period may be throughout the year or during all or part of the growing season.

Planned grazing systems result in a uniform distribution of grazing and maintain maximum productivity over a period of years. They help to overcome the adverse effects of drought or other climatic conditions on plants. Planned grazing systems should be designed to meet the needs of the rancher. The location of fences and of watering facilities, range sites and condition classes, the kinds or classes of livestock, and economic factors are used in determining the best system on a particular ranch. Planned grazing systems can eventually increase the stocking rates in the pastures. They also help to control parasites and diseases among cattle because they generally result in cleaner pastures.

Deferred Grazing

Deferred grazing allows the plants a prolonged period of rest. If grazing is deferred throughout the growing season, the plant community can improve rapidly. The undisturbed grasses leave a mulch at the surface and thus increase the rate of water infiltration and reduce the susceptibility to erosion. Deferred grazing allows the desirable species to mature and flower and to seed naturally.

The range condition determines the need for deferment. A beneficial deferment lasts for at least 3 months. It coincides with the food-storage period of desirable plants. This period varies, depending on the grass species. It is usually August to October for warm-

season grasses. On some sites, a deferment of 3 months is long enough. On other sites, however, a deferment of two complete growing seasons may be needed. Following the period of deferment, the pasture can be grazed after the first hard frost in the fall and early in the spring.

Range Seeding

In some areas improved range management alone cannot restore a satisfactory cover of native vegetation. Some of these areas are formerly cultivated fields, abandoned farmsteads, and severely overgrazed sites where the original native vegetation has been removed. Range seeding may be needed in these areas.

Good stands of native grasses can be reestablished if good management is applied. The seedbed should be properly prepared. Well suited species of native grasses should be selected for planting. Proper seeding methods and careful management are necessary after seeding. Range seeding is most successful when the seedbed has a mulch cover, which helps to keep the soil moist, lowers the surface soil temperature, and helps to control erosion. A temporary crop, such as rye, sudangrass, millet, or sorghum, can provide a mulch cover. The grass can be seeded directly into the stubble during the following fall, winter, or spring. Tillage should be avoided because a firm seedbed is needed. On the sandier soils, preparing the seedbed and planting the seeds in narrow strips over a period of several years or using a range interseeder helps to prevent excessive soil blowing.

Seeding mixtures should be of suitable native grass species that are normally on the site. Consequently, they vary according to the range site. Use of a grassland drill with depth bands ensures good placement of seeds at a uniform depth. On soils in the Sands and Choppy Sands range sites and on other soils where seedbed preparation will result in a severe hazard of soil blowing, a range interseeder should be used.

Newly seeded areas should not be grazed until after the grass is established. Establishment may take 2 or 3 years, depending on the grass species, the range site, and the method of planting. Initial grazing of these areas should be light. Grazing late in fall and in winter is desirable until the grass cover has reached the desired density.

Additional information about appropriate grass mixtures, grassland drills, and planting times can be obtained from local offices of the Soil Conservation Service and the Lower Loup Natural Resources District.

Control of Blowouts

Blowouts form in areas of sandy soils where tillage or heavy grazing has removed the vegetation. Most blowouts in the sandhills are along livestock trails or in overgrazed areas. Many large blowouts have formed on sites for wells, where livestock tend to concentrate. Smaller blowouts generally form along trails or fence lines. Drought increases the likelihood that blowouts will form.

Unless stabilized, blowouts are likely to enlarge as the wind blows the bare sand to the bordering areas. The windblown sand smothers the vegetation in those areas. A planned grazing system can stabilize many blowouts in 4 or 5 years. A stable grade should be established on the steep banks around the edge of the blowout. Otherwise, the steep slopes cannot be revegetated and will be a constant source of shifting sand. Locating wells and salting facilities away from the blowout helps to prevent the concentration of livestock in the area.

Reseeding may be necessary in areas where a natural seed source is not available and on large blowouts. Fences are needed to keep livestock away from the blowout. The edges should be shaped to a suitable grade. If a fast-growing summer cover crop is planted in the spring, a suitable mixture of native grass seed can be drilled into the stubble left from the crop. The cover crop helps to control soil blowing and improves the seedbed. If a cover crop is not practical, a mulch of native hay can be spread over the surface and worked into the sand. After the blowout is seeded, the mulch helps to prevent the damage caused by windblown sand while the grasses are becoming established. Proper grazing use and a planned grazing system help to prevent the reactivation of stabilized blowouts after the grasses are established.

Brush Control

Small soapweed, western snowberry, eastern redcedar, sumac, and American plum are the main brush species in Loup County. They encroach on the land, shade out desirable grasses, and reduce forage yields. Western snowberry, eastern redcedar, sumac, and American plum grow mainly in areas of loess and in transitional areas between deposits of loess and deposits of sand. Small soapweed can be a problem on Choppy Sands and Thin Loess range sites. It can be controlled by selective grazing. If it is grazed during the winter, it loses vigor and may be broken off below the root crown. Using cottonseed cake as a protein supplement increases the consumption of small

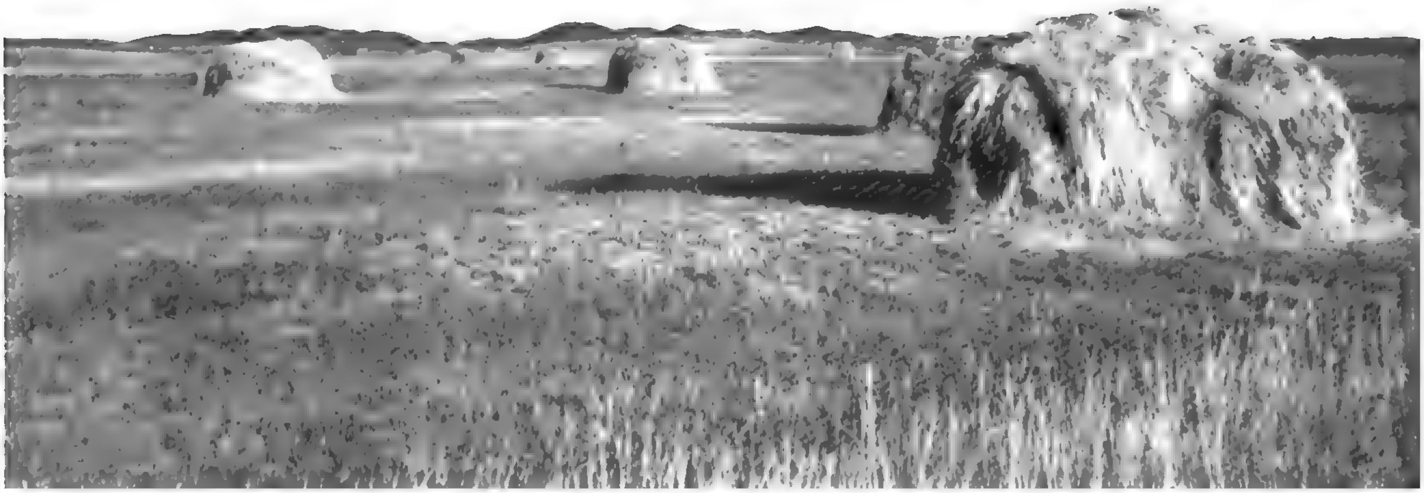

Figure 13.—A native hay meadow in an area of Tryon-Els loamy fine sands, 0 to 2 percent slopes. The Tryon soil is in the Wet Subirrigated range site, and the Els soil is in the Subirrigated range site.

soapweed by cattle. Approved herbicides are effective only in spots.

Approved herbicides are the best means of controlling western snowberry, sumac, and American plum. Repeated applications may be needed during succeeding years. Further information about the use of herbicides can be obtained from the local offices of the Soil Conservation Service and the Cooperative Extension Service.

Cutting is the best means of controlling eastern redcedar. Cutting the trees at ground level, below any green tissue, prevents most future growth. The trees can be cut by hand or by earthmovers where the slopes and topography are suitable. Generally, followup cutting is necessary after earthmovers are used. Approved herbicides or hand cutting can help in removing the rest of the trees. Deferment of grazing after earthmovers or chemicals are used helps to restore plant vigor and forage quality.

Managing Native Hayland

Many areas of range in Loup County are used for native hay. In most of these areas the soils have a seasonal high water table and are in the Wetland, Wet Subirrigated, and Subirrigated range sites (fig. 13). Hay is harvested in a few upland or valley areas usually used for grazing. These areas generally are in the Sandy Lowland, Sandy, or Sands range site.

Proper management can maintain or improve hay production on the wet meadows. Timely mowing is needed to maintain strong plant vigor and a healthy stand. If mowing is deferred during the period between the boot stage and seed maturity, the plant roots can store more carbohydrates. The boot stage is just prior to the emergence of seed heads. Large meadows can be divided into three sections, and the sections can be mowed in rotation. One section should be mowed about 2 weeks before the plants reach the boot stage; another section, at the boot stage; and the last section, early in

the flowering period. The order in which the sections are mowed should be changed in successive years. A mowing height of 3 inches or more helps to maintain plant vigor.

Meadows should not be grazed or harvested for hay when the soil is wet or the water table is within a depth of 6 inches. Grazing or the use of heavy machinery during these periods can result in the formation of small bogs, ruts, or mounds, which can hinder mowing in later years. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws and the soil becomes wet in the spring.

Applications of phosphorus fertilizer increase forage production on wet meadows. They stimulate the growth of clover and grasses and thus increase the value and yield of hay.

If the drier sites are used for hay, the forage should be harvested only every other year. During the following year, grazing only in fall or winter allows the warm-season grasses to gain vigor and decreases the abundance of the cool-season grasses and of weeds. The optimum time for mowing is just before the dominant grasses reach the boot stage. Mowing should be regulated so that the desirable grasses remain vigorous and healthy. Early mowing allows the plants enough time to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply.

Technical assistance in managing range and hayland can be obtained from the local office of the Soil Conservation Service or the Lower Loup Natural Resources District.

Windbreaks and Environmental Plantings

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

Windbreaks and environmental plantings have been planted at various times on most farmsteads and ranch headquarters in Loup County. Windbreaks are also used to protect fields and livestock. Siberian elm, eastern redcedar, and eastern cottonwood are the dominant species. Other common species are boxelder, ponderosa pine, silver maple, green ash, and Russian mulberry.

New trees and shrubs are continually needed because old ones pass maturity and deteriorate and some trees and shrubs are destroyed by insects, diseases, and storms. Also, new windbreaks are needed in areas where farming or ranching is expanding.

Windbreaks that protect livestock are in scattered areas of range throughout the county. Most of these consist of six to eight rows of eastern redcedar.

Field windbreaks and shelterbelts are common in the county. Most shelterbelts consist of eight to ten rows of trees and shrubs. Many trees and shrubs were planted under the Prairie States Planting Program in the 1930's and 1940's. Eastern cottonwood is the dominant species in field windbreaks, especially in areas of the Cozad-Hord association. Other species in field windbreaks include Siberian elm, Russian mulberry, honeylocust, hackberry, eastern redcedar, American plum, lilac, ponderosa pine, common chokecherry, green ash, and black locust. Many field windbreaks and shelterbelts have reached maturity and are deteriorating. Renovation through thinning, removal, and replanting or through supplemental planting is needed.

In order for windbreaks and environmental plantings to fulfill their intended purpose, the species selected for planting should be suited to the soil on the site. Selecting suitable species is the first step toward ensuring survival and maximum growth rates. Permeability, available water capacity, fertility, soil texture, and soil depth greatly affect the growth rates.

Establishing trees and shrubs is somewhat difficult in Loup County because of dry conditions and the competition from other vegetation. Preparing the site properly before planting and controlling competition from weeds and grasses after planting are important management concerns. A cover crop is needed on the sandy soils to protect the newly planted trees from the hot winds and from windblown sand. Supplemental watering is needed when the seedlings are becoming established. Dead trees should be replaced during the first 3 years after planting.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens.

At the end of each description under the heading "Detailed Soil Map Units," the soil has been assigned to a windbreak suitability group. These groups are based primarily on the suitability of the soil for the locally adapted species, as is indicated by their growth and vigor. Detailed interpretations for each windbreak suitability group in the county are provided in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Native Woodland

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

Woodland makes up less than 1 percent of the land area in Loup County. It occurs as a gallery forest along the major streams and rivers. Other native woody vegetation grows on steep uplands and on the edge of wet areas. The acreage of woodland is small and scattered and thus is of limited value as a commercial resource. The woodland, however, is an important resource for local use.

The gallery forest depends on the availability of ground water along the river. It is maintained at less than the climax of a deciduous forest because of the semiarid environment and the lack of seed sources. The Ord-Bolent-Almeria association has the densest woodland in the county. Eastern cottonwood, boxelder, green ash, American plum, dogwood, and indigobush are the dominant species. Other species include American elm, smooth sumac, black willow, sandbar willow, hackberry, eastern redcedar, blackberry, and western snowberry. The Almeria-Calamus-Bolent association is sparsely wooded. Willows, boxelder, indigobush, and dogwood are the dominant species in this association. A few eastern cottonwood, black willow, and sandbar willow grow on the edge of wet areas in sandhill valleys. In addition, the steep, north-facing slopes in some areas of the sandhills support American plum, common chokecherry, golden currant, western snowberry, and sandcherry.

Eastern redcedar is spreading onto the steep uplands of the Coly-Uly-Hobbs association. Boxelder, green ash, American elm, smooth sumac, hackberry, American plum, and common chokecherry also grow in areas of this association.

Recreation

Robert O. Koerner, biologist, Soil Conservation Service, helped prepare this section.

The chief recreational activities in Loup County are hunting, fishing, and trapping (fig. 14). Prairie grouse, mule deer, white-tailed deer, pheasant, bobwhite quail, waterfowl, and mourning dove are hunted on private lands during the hunting season. Hunting for pheasant and bobwhite quail is limited to areas where cropland, woodland, and grasslands merge and along the North Loup and Calamus Rivers. Some furbearers are trapped along those rivers.

Fishermen can catch catfish, bullhead, bluegill, largemouth bass, walleye, and northern pike in the North Loup and Calamus Rivers. The farm ponds throughout the county also are inhabited by largemouth bass, catfish, and bluegill. The Calamus River and some stretches of the North Loup River are popular streams for canoeing.

The Calamus Reservoir, located on the Calamus River about 6 miles northwest of Burwell, is the most important of the fishing waters in the county. The dam is located in Garfield County, but most of the reservoir is in Loup County. The reservoir covers about 5,150 surface acres. It is about 10 miles long and about 1 mile wide at the widest point. Its shoreline is about 36 miles long. Migrating waterfowl that stop and rest at the reservoir provide opportunities for hunting. Other recreational facilities at the reservoir include a major daytime area, two small daytime areas, camping facilities, picnic areas, and boat ramps.

Technical assistance in designing recreational facilities is available at the local office of the Soil Conservation Service.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent

Figure 14.—A reservoir on Gracie Creek that provides opportunities for hunting and fishing.

and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and the frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding

during the period of use, and do not have slopes that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is firm after rains and is not dusty when dry. If grading is needed, the depth of the soil over gravel or the seasonal high water table should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Robert O. Koerner, biologist, Soil Conservation Service, helped prepare this section.

The kinds of wildlife habitat in Loup County vary, depending on the soil, topography, vegetation, slope, and drainage pattern. Most of Loup County is in the Nebraska Sandhills. The sandhills include the Valentine, Valentine-Ipage, Valentine-Hersh-Gates, Valentine-Tryon-Ipage, and Valentine-Simeon-Boelus associations. These associations provide habitat for mule deer, white-tailed deer, badger, coyote, skunk, opposum, meadowlarks, bob-o-links, and lark buntings. The wildlife near the wetlands in the Valentine-Tryon-Ipage association include shore birds, waterfowl, mink, muskrat, and other wetland wildlife.

The chief plants in the sandhills are sand bluestem, little bluestem, prairie sandreed, and blue grama. The dominant plants in the wet sandhill valleys are big bluestem, switchgrass, prairie cordgrass, cattails, sedges, and rushes.

During the winter months, the wildlife species are attracted to areas that provide food and protective cover. These include livestock-feeding areas, woody cover in draws, field windbreaks, and shelterbelts. In the sandhills, areas of woody cover are sparse. The cropland in the sandhills is confined mostly to swales in the Valentine-Hersh-Gates association. Cropland also is available in the Els-Tryon-Ipage association. It is dominant in the Hersh-Gates-Valentine and Cozad-Hord associations, south of the North Loup River. Woody cover also is more common in these associations.

The Coly-Uly-Hobbs association occurs as areas of woody plants and open range. It is inhabited by a variety of songbirds and other wildlife species. The population of wild turkeys is increasing in this association as the habitat is favorable.

The areas along the North Loup River include the Ord-Bolent-Almeria association on bottom land and the Ipage-Valentine-Elsmere and Cozad-Hord associations on stream terraces. These associations provide food, cover, and water for wetland and other wildlife species. White-tailed deer, mule deer, bobwhite quail, cottontail, jackrabbit, and ring-necked pheasant use the riparian habitat along the North Loup River as escape cover. They venture out to the cropland to feed.

A great blue heron rookery has been established on the upper reaches of the Calamus Reservoir. Planting more windbreaks and blocks of evergreen trees could improve the winter cover for wildlife adjacent to the reservoir.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. Arating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, Kentucky bluegrass, smooth bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are little bluestem, goldenrod, western wheatgrass, and blue grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are green ash, honeylocust, hackberry, dogwood, and eastern cottonwood. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian olive, common chokecherry, and American plum.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are ponderosa pine, eastern redcedar, and Rocky Mountain juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are sand cherry, Amur honeysuckle, western snowberry, and sumac.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, and slope. Examples of wetland plants are cattails, prairie cordgrass, rushes, sedges, and northern reedgrass.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl-feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, coyote, and cottontail.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, thrushes, woodpeckers, squirrels, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include deer, sharp-tailed grouse, prairie chicken, meadowlark, and lark bunting.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use

planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design,significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to amaximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by gravel content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A seasonal high water table, flooding, gravel,

and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Sandy areas may interfere with installation because of the tendency of cutbanks to cave.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and gravel can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding

affect both types of landfill. Texture, gravel content, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil lowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by gravel content, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential and slopes of 15 to 25 percent. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil) and the thickness of suitable material. Acidity and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also

evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They have little or no gravel and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of gravel, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by slope and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts or sodium. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, gravel content, and slope. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce water erosion and conserve moisture by intercepting runoff. Slope, wetness, and gravel

content affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters

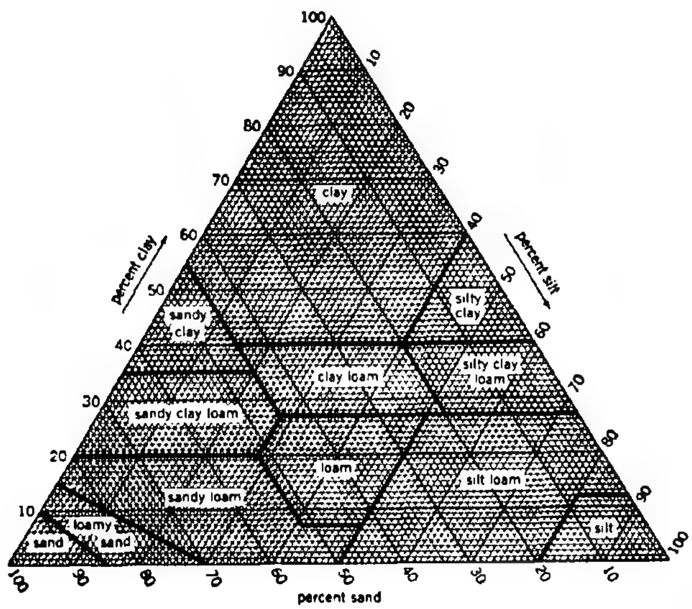

Figure 15.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

in diameter (fig. 15). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(3)* and the system adopted by the American Association of State Highway and Transportation Officials *(2)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and

clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential s the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing erosion are used.

4L. Calcareous, loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, and by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table, the kind of water table, and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18. An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium

content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Specific gravity T—100 (AASHTO). The group index number that is part of AASHTO classification is computed by using the Nebraska Modified System.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(7)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (6)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (7)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Almeria Series

The Almeria series consists of deep, poorly drained and very poorly drained, rapidly permeable soils formed in sandy alluvium. These soils are on bottom land along the major rivers and streams in the sandhills. Slopes range from 0 to 2 percent.

Almeria soi s are similar to Tryon soils and are commonly adjacent to Bolent and Calamus soils and to Fluvaquents. Tryon soils are in sandhill valleys. They are not stratified in the upper part. Bolent and Calamus soils are higher on the landscape than the Almeria soils and are better drained. Fluvaquents are lower on the landscape than the Almeria soils and are covered with water for most of the growing season.

Typical pedon of Almeria loamy fine sand, 0 to 2 percent slopes, 100 feet north and 100 feet east of the southwest corner of sec. 13, T. 22 N., R. 20 W.

A—0 to 5 inches; dark gray (10YR 4/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; thin strata of light gray fine sand; mildly alkaline; slight effervescence at the surface; clear smooth boundary.

C1—5 to 18 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; common fine and medium distinct dark yellowish brown (10YR 4/6 moist) and yellowish brown (10YR 5/6 moist) mottles; single grain; loose; few thin strata of fine sand and coarse sand; neutral; clear smooth boundary.

C2—18 to 30 inches; stratified light brownish gray (10YR 6/2) fine sand and grayish brown (10YR 5/2) loamy very fine sand, grayish brown (10YR 5/2) and dark grayish brown (2.5Y 4/2) moist; common medium and fine distinct dark yellowish brown (10YR 4/6 moist) and yellowish brown (10YR 5/6 moist) mottles; single grain; loose; slightly acid; clear wavy boundary.

C3—30 to 36 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; massive; slightly hard, very friable; slightly acid; clear smooth boundary.

C4—36 to 45 inches; stratified dark gray (10YR 4/1) fine sandy loam and light gray (10YR 6/1) fine sand, very dark gray (10YR 3/1) and gray (10YR 5/1) moist; single grain; loose; neutral; clear wavy boundary.

C5—45 to 60 inches; gray (10YR 5/1) fine sand, dark gray (10YR 4/1) moist; single grain; loose; neutral.

Free carbonates generally are at the surface. In some pedons, however, they are as much as 30 inches from the surface.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 6 (2 to 5 moist), and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes fine sandy loam and loam. This horizon is 2 to 9 inches thick. A few pedons have an AC horizon. This horizon is intermediate in color between the A and C horizons. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 8 (2 to 7 moist), and chroma of 1 to 3. It is dominantly sand, fine sand, or loamy fine sand, but strata of loamy very fine sand, fine sandy loam, or loam are common and some pedons have thin strata of coarse sand and gravelly coarse sand.

Boelus Series

The Boelus series consists of deep, well drained soils formed in sandy eolian material deposited over loamy and sandy alluvium. These soils are on stream terraces. Permeability is rapid in the sandy upper layers, moderate in the loamy middle layers, and rapid in the sandy underlying material. Slopes range from 0 to 3 percent.

The Boelus soils in Loup County are taxadjuncts because they do not have a mollic epipedon and formed under a slightly drier climate than is defined as the range for the series. These differences, however, do not alter the usefulness or behavior of the soils.

Boelus soils are commonly near Ipage, Simeon, and Valentine soils. The nearby soils have more sand in the underlying material than the Boelus soils. Also, Ipage and Simeon soils are lower on the landscape, and Valentine soils are higher on the landscape.

Typical pedon of Boelus loamy fine sand, sandy substratum, 0 to 3 percent slopes, 2,200 feet west and 1,200 feet north of the southeast corner of sec. 11, T. 22 N., R. 19 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

A2—6 to 14 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

Bw1—14 to 23 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral; abrupt smooth boundary.

2Bw2—23 to 28 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium subangular

blocky structure; slightly hard, friable; neutral; clear smooth boundary.

2Bw3—28 to 36 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, very friable; neutral; clear smooth boundary.

2BC—36 to 41 inches; light brownish gray (10YR 6/2) sandy loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; neutral; abrupt smooth boundary.

2C—41 to 60 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; single grain; loose; neutral.

The mollic colors extend to a depth of 5 to 9 inches. Depth to the loamy 2Bw horizon ranges from 20 to 36 inches. Depth to the 2C horizon ranges from 40 to 60 inches. Carbonates are below a depth of 60 inches.

The A horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes loamy sand. Some pedons have an AC horizon. The Bw horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is sand, fine sand, loamy sand, or loamy fine sand. The 2Bw horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam, clay loam, or sandy clay loam in the upper part and loam, fine sandy loam, or sandy loam in the lower part. The 2C horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 to 6 moist), and chroma of 2 to 4. It is coarse sand, sand, or fine sand.

Bolent Series

The Bolent series consists of deep, somewhat poorly drained, rapidly permeable soils formed in sandy alluvium on bottom land. Slopes range from 0 to 2 percent.

Bolent soils are similar to Els soils and are commonly near Almeria, Calamus, Loup, and Ord soils. Els soils are not stratified. Almeria and Loup soils are lower on the landscape than the Bolent soils and are poorly drained and very poorly drained. Calamus soils are higher on the landscape than the Bolent soils and are better drained. Ord soils are loamy in the upper part. They are in landscape positions similar to those of the Bolent soils.

Typical pedon of Bolent loamy fine sand, 0 to 2 percent slopes, 800 feet west and 150 feet south of the northeast corner of sec. 23, T. 22 N., R. 20 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; slight effervescence; moderately alkaline; clear smooth boundary.

C1—6 to 19 inches; stratified light brownish gray (10YR 6/2) and dark grayish brown (10YR 4/2) loamy fine sand, sand, and fine sandy loam, grayish brown (10YR 5/2) and very dark grayish brown (10YR 3/2) moist; single grain; loose; moderately alkaline; abrupt smooth boundary.

C2—19 to 60 inches; stratified white (10YR 8/1) and light gray (10YR 6/1) sand, coarse sand, and loamy very fine sand, light brownish gray (10YR 6/2) and gray (10YR 5/1) moist; common medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; moderately alkaline.

Typically, carbonates are at the surface. In some pedons, however, they have been leached out of the profile.

The A horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes fine sandy loam and loam. Some pedons have an AC horizon, which is intermediate in color and texture between the A and C horizons. The C horizon has hue of 10YR or 2.5Y, value of 4 to 8 (3 to 7 moist), and chroma of 1 to 3. It has reddish brown or yellowish brown mottles. It is dominantly loamy fine sand, fine sand, and sand, but it has strata of silt loam to gravelly coarse sand.

Calamus Series

The Calamus series consists of deep, moderately well drained, rapidly permeable soils formed in sandy alluvium on bottom land. Slopes range from 0 to 2 percent.

Calamus soils are similar to Ipage soils and are commonly adjacent to Almeria and Bolent soils. Ipage soils are not stratified in the upper part. They are on stream terraces and in sandhill valleys. Almeria and Bolent soils are lower on the landscape than the Calamus soils. Almeria soils are poorly drained and very poorly drained. Bolent soils are somewhat poorly drained.

Typical pedon of Calamus loamy fine sand, 0 to 2 percent slopes, 2,300 feet west and 200 feet north of the southeast corner of sec. 32, T. 23 N., R. 20 W.

A—0 to 5 inches; grayish brown (10YR 5/2) loamy fine sand, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

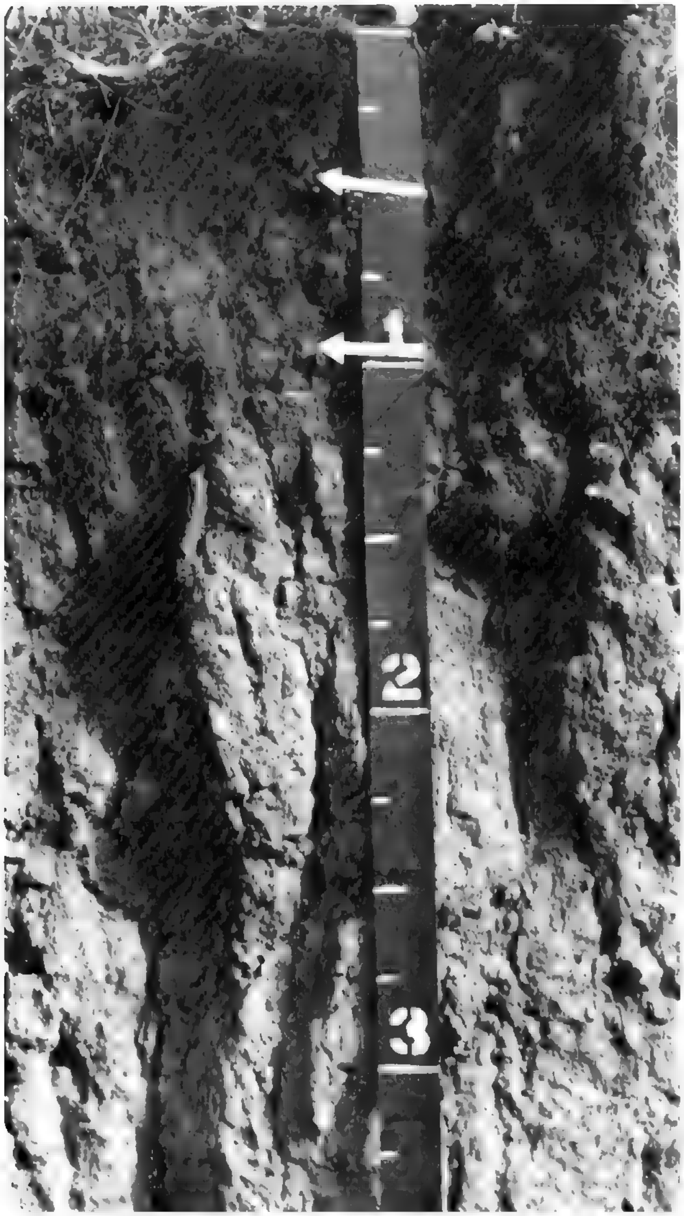

Figure 16.—Profile of a Coly silt loam. The upper arrow indicates the bottom of the surface layer, and the lower arrow indicates the bottom of the transition layer. Depth is marked in feet.

AC—5 to 14 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; slightly acid; clear smooth boundary.

C1—14 to 21 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; single grain; loose; few thin strata of fine sandy loam and coarse sand; slightly acid; clear smooth boundary.

C2—21 to 30 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; single grain; loose; few thin strata of fine sand and coarse sand; about 3 percent gravel, by volume; slightly acid; clear smooth boundary.

C3—30 to 55 inches; light gray (10YR 7/2), stratified fine sand, sand, and coarse sand, light brownish gray (10YR 6/2) moist; few medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; about 10 percent gravel, by volume; slightly acid; clear smooth boundary.

C4—55 to 60 inches; light gray (10YR 7/2) gravelly coarse sand, light brownish gray (10YR 6/2) moist; few medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; about 18 percent gravel, by volume; slightly acid.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes loamy sand and fine sand. This horizon is 3 to 9 inches thick. The AC horizon, if it occurs, has colors and textures intermediate between those of the A and C horizons. The C horizon has value of 5 to 8 (4 to 7 moist) and chroma of 1 to 3. It has few or common, faint to prominent, yellowish brown or reddish brown mottles within a depth of 40 inches. It is dominantly sand that has strata of coarse sand or gravelly coarse sand. In some pedons, however, it has thin strata of fine sand to fine sandy loam.

Coly Series

The Coly series consists of deep, excessively drained moderately permeable soils formed in loess on uplands (fig. 16). Slopes range from 17 to 60 percent.

Coly soils are similar to Gates soils and are commonly adjacent to Hobbs and Uly soils. Gates soils have less clay throughout than the Coly soils and have carbonates lower in the profile. Hobbs soils are stratified and have carbonates lower in the profile. They are on bottom land. Uly soils are higher on the landscape than the Coly soils. Also, they have a thicker surface layer.

Typical pedon of Coly silt loam, in an area of Coly-Hobbs silt loams, 2 to 60 percent slopes; 1,900 feet west and 600 feet south of the northeast corner of sec. 32, T. 21 N., R. 18 W.

A—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

AC—5 to 10 inches; light brownish gray (10YR 6/2) silt

loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; slightly hard, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C1—10 to 40 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—40 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 3 to 14 inches. The depth to free carbonates is typically less than 10 inches.

The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. The AC and C horizons have value of 5 to 7 (4 to 6 moist).

Cozad Series

The Cozad series consists of deep, well drained, moderately permeable soils formed in silty alluvium on stream terraces. Slopes range from 0 to 3 percent.

Cozad soils are adjacent to Hersh and Hord soils. Hersh soils have more sand in the control section than the Cozad soils. Also, they are slightly higher on the landscape. Hord soils have a mollic epipedon more than 20 inches thick. They are in landscape positions similar to those of the Cozad soils.

Typical pedon of Cozad silt loam, 0 to 1 percent slopes, 2,100 feet east and 1,900 feet north of the southwest corner of sec. 21, T. 21 N., R. 18 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.

A—6 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral; clear smooth boundary.

Bw—12 to 18 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, very friable; neutral; abrupt smooth boundary.

BC—18 to 26 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1—26 to 37 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, very friable; thinly stratified; strong effervescence; moderately alkaline; clear smooth boundary.

C2—37 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; thinly stratified; secondary threads of calcium carbonate; strong effervescence; moderately alkaline.

The solum ranges from 14 to 30 inches in thickness. The mollic epipedon ranges from 10 to 20 inches in thickness. The depth to carbonates ranges from 10 to 48 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silt loam, but in some pedons it is loam, very fine sandy loam, or fine sandy loam. The Bw horizon has value of 5 or 6 (3 or 4 moist). It is silt loam or very fine sandy loam. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It is dominantly silt loam or very fine sandy loam, but it commonly has thin layers of finer and coarser textured material. Buried soils are common.

Els Series

The Els series consists of deep, somewhat poorly drained, rapidly permeable soils formed in sandy eolian and alluvial material (fig. 17). These soils are in sandhill valleys and on stream terraces. Slopes range from 0 to 2 percent.

Els soils are similar to Bolent and Elsmere soils and are commonly near Ipage, Marlake, Tryon, and Valentine soils. Bolent soils are stratified. Elsmere soils have a dark colored surface layer that is thicker than that of the Els soils. Ipage and Valentine soils are higher on the landscape than the Els soils and are better drained. Marlake and Tryon soils are lower on the landscape than the Els soils and are poorly drained and very poorly drained.

Typical pedon of Els loamy sand, 0 to 2 percent slopes, 2,600 feet east and 2,000 feet north of the southwest corner of sec. 20, T. 24 N., R. 17 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loamy sand, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

AC—6 to 9 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; slightly acid; clear smooth boundary.

C1—9 to 18 inches; light brownish gray (10YR 6/2) fine

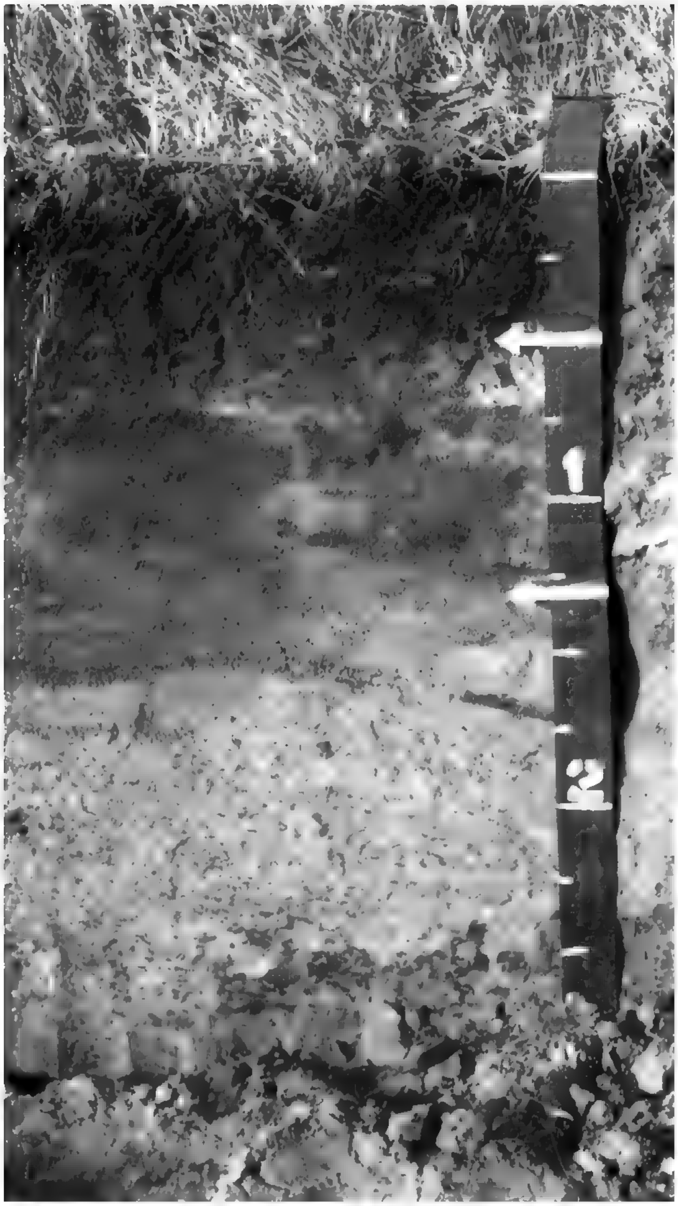

Figure 17.—Typical profile of an Els loamy sand. The upper arrow indicates the bottom of the surface layer, and the lower arrow indicates the bottom of the transition layer. Depth is marked in feet.

sand, grayish brown (10YR 5/2) moist; common fine and medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; neutral; gradual smooth boundary.

C2—18 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common fine and medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; neutral.

The thickness of the solum ranges from 6 to 19 inches. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loamy sand, but the range includes loamy fine sand and fine sand. This horizon is 6 to 9 inches thick. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 to 3. It is dominantly fine sand, but in some pedons it is loamy sand or loamy fine sand. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 or 3. It has brownish yellow or yellowish brown mottles. It is dominantly fine sand, but in some pedons it is sand or loamy sand and in others gravelly sand is below a depth of 40 inches. Also, some pedons have thin strata of dark colored loamy fine sand or sand in the C horizon.

Elsmere Series

The Elsmere series consists of deep, somewhat poorly drained, rapidly permeable soils formed in sandy alluvium on stream terraces. Slopes range from 0 to 2 percent.

Elsmere soils are similar to Els soils and are commonly near Bolent, Ipage, and Ord soils. Els soils do not have a mollic epipedon. Bolent soils are stratified and do not have a mollic epipedon. They are lower on the landscape than the Elsmere soils. Ipage soils are higher on the landscape than the Elsmere soils and are moderately well drained. Ord soils are loamy in the upper part. They are on bottom land.

Typical pedon of Elsmere loamy fine sand, 0 to 2 percent slopes, 2,300 feet east and 200 feet north of the southwest corner of sec. 33, T. 23 N., R. 20 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; medium acid; abrupt smooth boundary.

A1—6 to 10 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; medium acid; clear smooth boundary.

A2—10 to 14 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; medium acid; clear smooth boundary.

C1—14 to 20 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; weak fine subangular blocky structure; soft, very

Figure 18.—Typical profile of a Gates silt loam. Lime is at a depth of about 23 inches. The upper arrows indicate the transition layer. Depth is marked in feet.

friable; medium acid; clear smooth boundary.

C2—20 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; few fine distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; slightly acid.

The mollic epipedon ranges from 10 to 20 inches in thickness. The solum ranges from 12 to 36 inches in thickness.

The A horizon has value of 3 to 5 and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes loamy sand and fine sandy loam. Some pedons have an AC horizon. This horizon has value of 2 to 6 (2 to 4 moist) and chroma of 1 or 2. It is loamy fine sand, loamy sand, or fine sand. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It has few to many yellowish brown, dark brown, or dark reddish brown mottles. It is dominantly fine sand, loamy fine sand, or sand. The upper part of this horizon, however, commonly has strata of fine sandy loam or very fine sandy loam about 4 to 8 inches thick.

Gates Series

The Gates series consists of deep, well drained to excessively drained, moderately permeable soils on uplands. These soils formed in loess and reworked loamy material (fig. 18). Slopes range from 0 to 60 percent.

Gates soils are similar to Coly soils and are adjacent to Hersh and Valentine soils. Coly soils contain more clay than the Gates soils and have calcium carbonates at the surface. They are in landscape positions similar to those of the Gates soils. Hersh soils also are in similar landscape positions. They have more sand in the control section than the Gates soils. Valentine soils are higher on the landscape than the Gates soils. They are sandy throughout.

Typical pedon of Gates silt loam, 1 to 3 percent slopes, 1,000 feet north and 300 feet east of the southwest corner of sec. 28, T. 22 N., R. 20 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

AC—6 to 14 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

C1—14 to 21 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; mildly alkaline; clear smooth boundary.

C2—21 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 7 to 22 inches. The depth to carbonates ranges from 12 to 30 inches. Threads of carbonate are common in the C horizon. Iron stains also are common in the C horizon.

The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 to 3. It is dominantly silt loam, but the range includes very fine sandy loam. This horizon is 3 to 6 inches thick. The AC and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. They are silt loam or very fine sandy loam.

Hersh Series

The Hersh series consists of deep, well drained to excessively drained, moderately rapidly permeable soils formed in mixed loamy and sandy eolian material. These soils are on uplands. Slopes range from 0 to 60 percent.

Hersh soils are adjacent to Gates, Valentine, and Vetal soils. Gates soils are in positions on the landscape similar to those of the Hersh soils. They have less sand in the control section than the Hersh soils. Valentine soils are sandy. They are higher on the landscape than the Hersh soils. Vetal soils have a dark colored surface soil more than 20 inches thick. They are lower on the landscape than the Hersh soils.

Typical pedon of Hersh fine sandy loam, 3 to 6 percent slopes, 2,550 feet west and 2,100 feet south of the northeast corner of sec. 17, T. 21 N., R. 17 W.

Ap—0 to 6 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

AC—6 to 16 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; soft, very friable; slightly acid; clear smooth boundary.

C1—16 to 35 inches; very pale brown (10YR 7/3) loamy very fine sand, pale brown (10YR 6/3) moist; massive; soft, very friable; neutral; gradual smooth boundary.

C2—35 to 60 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose; neutral.

The thickness of the solum ranges from 4 to 24 inches. In most places carbonates are below a depth of 60 inches.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes very fine sandy loam and loamy fine sand. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is fine sandy loam or loamy very fine sand. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is fine sandy loam, loamy very fine sand, or loamy fine sand.

Hobbs Series

The Hobbs series consists of deep, well drained, moderately permeable soils formed in silty alluvium on bottom land. Slopes range from 0 to 3 percent.

Hobbs soils are adjacent to Coly, Cozad, Hord, and Uly soils. Coly soils formed in loess on upland side slopes. Cozad and Hord soils have a mollic epipedon and a Bw horizon. They are higher on the landscape than the Hobbs soils. Uly soils have a mollic epipedon. They are on upland side slopes.

Typical pedon of Hobbs silt loam, in an area of Coly-Hobbs silt loams, 2 to 60 percent slopes; 2,300 feet west and 1,800 feet north of the southeast corner of sec. 29, T. 21 N., R. 18 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

C—6 to 16 inches; stratified dark grayish brown (10YR 4/2) and light brownish gray (10YR 6/2) silt loam, black (10YR 2/1) and dark grayish brown (10YR 4/2) moist; weak thin and medium platy structure; slightly hard, very friable; neutral; clear smooth boundary.

Ab—16 to 26 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; weak thin and medium platy structure; soft, very friable; neutral; clear smooth boundary.

C'1—26 to 48 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; thin strata of fine sandy loam; neutral; gradual smooth boundary.

C'2—48 to 60 inches; stratified very pale brown (10YR 7/3) and brown (10YR 5/3) very fine sandy loam and silt loam, brown (10YR 5/3) and dark brown (10YR 4/3) moist; weak thin and medium platy structure; soft, very friable; thin strata of loamy fine sand and fine sandy loam; neutral.

Most pedons do not have carbonates in the upper 40 inches. In some pedons, however, carbonates are in thin layers of recently deposited material. Buried soils are common.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silt loam, but in some pedons it is fine sandy loam. The C horizon typically has hue of 10YR or 2.5Y, value of 4 to 7 (3 to 6 moist),

and chroma of 1 to 3. It is commonly stratified with thin layers of lighter or darker material. It is dominantly silt loam, but it commonly has strata of silty clay loam, loamy fine sand, fine sandy loam, or very fine sandy loam.

Hord Series

The Hord series consists of deep, well drained, moderately permeable soils formed in mixed loess and alluvium on stream terraces. Slopes are 0 to 1 percent.

Hord soils are adjacent to Cozad, Hobbs, and Uly soils. Cozad and Uly soils have a mollic epipedon less than 20 inches thick. Cozad soils are in landscape positions similar to those of the Hord soils. Uly soils are on upland side slopes. Hobbs soils are stratified. They are in the lower areas along narrow drainageways.

Typical pedon of Hord silt loam, 0 to 1 percent slopes, 2,400 feet east and 2,450 feet north of the southwest corner of sec. 34, T. 21 N., R. 17 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; medium acid; abrupt smooth boundary.

A—7 to 18 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; slightly acid; clear smooth boundary.

Bw—18 to 26 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral; clear smooth boundary.

BC—26 to 38 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; neutral; gradual smooth boundary.

C—38 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; thin threads of calcium carbonate; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 60 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches. The depth to free carbonates ranges from 30 to 48 inches.

The A horizon has value of 3 to 5. It is dominantly silt loam, but the range includes loam and very fine sandy loam. The Bw horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam. The C horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes very fine sandy loam, loam, and silty clay loam.

Ipage Series

The Ipage series consists of deep, moderately well drained, rapidly permeable soils formed in sandy eolian and alluvial material. These soils are in sandhill valleys and on stream terraces. Slopes range from 0 to 3 percent.

Ipage soils are similar to Calamus soils and are commonly adjacent to Els, Tryon, and Valentine soils. Calamus soils are stratified with coarse sand in the lower part. They are on bottom land along the major streams. Els and Tryon soils are lower on the landscape than the Ipage soils. Els soils are somewhat poorly drained. Tryon soils are poorly drained and very poorly drained. Valentine soils are higher on the landscape than the Ipage soils. They do not have mottles within a depth of 40 inches.

Typical pedon of Ipage fine sand, in an area of Els-Ipage fine sands, 0 to 3 percent slopes; 2,600 feet north and 250 feet west of the southeast corner of sec. 14, T. 24 N., R. 19 W.

A—0 to 5 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

AC—5 to 13 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear smooth boundary.

C1—13 to 36 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral, gradual smooth boundary.

C2—36 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; neutral.

The thickness of the solum ranges from 3 to 21 inches. The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 1 or 2. It is dominantly loamy fine sand or fine sand, but the range includes sand and loamy sand. This horizon is 3 to 10 inches thick. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is sand, fine sand, loamy sand, or loamy fine sand. The C horizon has value of 6 or 7 (4 to 6 moist). It has yellowish brown, strong brown, or dark reddish brown mottles within a depth of 40 inches. It is

dominantly sand, fine sand, loamy sand, or loamy fine sand. In some pedons, however, strata of coarser or finer textured material are below a depth of 40 inches.

Loup Series

The Loup series consists of deep, poorly drained, rapidly permeable soils formed in sandy alluvium on bottom land. Slopes range from 0 to 2 percent.

Loup soils are adjacent to Almeria, Bolent, Calamus, and Ord soils. Almeria soils are stratified and do not have a mollic epipedon. They are slightly lower on the landscape than the Loup soils. Bolent and Ord soils are higher on the landscape than the Loup soils and are somewhat poorly drained. Calamus soils do not have a mollic epipedon. They are moderately well drained and are higher on the landscape than the Loup soils.

Typical pedon of Loup fine sandy loam, 0 to 2 percent slopes, 1,400 feet east and 1,400 feet north of the southwest corner of sec. 23, T. 21 N., R. 18 W.

A1—0 to 4 inches; very dark gray (10YR 3/1) fine sandy oam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; clear wavy boundary.

A2—4 to 13 inches; dark gray (10YR 4/1) loamy fine sand, very dark gray (10YR 3/1) moist; few medium faint dark yellowish brown (10YR 4/4 moist) mottles; weak medium granular structure; soft, very friable; neutral; clear wavy boundary.

AC—13 to 17 inches; gray (10YR 5/1) loamy fine sand, dark gray (10YR 4/1) moist; common fine distinct dark yellowish brown (10YR 4/6 moist) mottles; weak coarse subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

C1—17 to 38 inches; light gray (10YR 7/1) fine sand, light brownish gray (10YR 6/2) moist; common medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; neutral; gradual smooth boundary.

C2—38 to 60 inches; white (10YR 8/1) sand, light gray (10YR 6/1) moist; single grain; loose; thin strata of coarse sand; neutral.

The thickness of the solum ranges from 10 to 22 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. In most pedons the upper 5 to 15 inches is calcareous.

The A horizon has chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loamy fine sand and loam. The AC horizon is intermediate in color and texture between the A and C horizons. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (4 to 7 moist), and chroma of 1 or 2. It has few to many, faint to prominent mottles. The lower part of this horizon has strata of finer or coarser textured material.

Marlake Series

The Marlake series consists of deep, very poorly drained, rapidly permeable soils formed in sandy alluvium. These soils are in depressions or basins on valley floors and in low areas bordering lakes. The seasonal high water table is above the surface during most of the growing season. Slopes range from 0 to 2 percent.

Marlake soils are adjacent to Els, Ipage, and Tryon soils. Els and Ipage soils are better drained than the Marlake soils and are higher on the landscape. Tryon soils are slightly higher on the landscape than the Marlake soils. They are not stratified.

Typical pedon of Marlake loamy fine sand, 0 to 2 percent slopes, 2,000 feet south and 100 feet east of the northwest corner of sec. 28, T. 24 N., R. 17 W.

A—0 to 6 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; thin strata of lighter colored material; moderately alkaline; clear smooth boundary.

AC—6 to 10 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; thin strata of lighter or darker colored material; few fine distinct yellowish brown (10YR 5/6 moist) mottles; weak medium subangular blocky structure; soft, very friable; moderately alkaline; clear wavy boundary.

C—10 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common fine distinct yellowish brown (10YR 5/6 moist) mottles; mixed with dark gray (10YR 4/1) loamy fine sand; single grain; loose; mildly alkaline.

The thickness of the solum ranges from 6 to 25 inches. In a few pedons some layers in the C horizon have carbonates.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes loamy sand, sandy loam, and fine sandy loam. The AC horizon has hue of 10YR or 2.5Y, value of 3 to 7 (2 to 6 moist), and chroma of 1 to 3. It is dominantly loamy fine sand or loamy sand, but it is stratified or mixed with coarse sand to fine sandy loam in some pedons. The C horizon has hue of 10YR to 5Y,

value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. It is dominantly sand, fine sand, or loamy fine sand, but it commonly has strata of finer or coarser textured material. Dark colored buried layers are common. The AC and C horizons have few or common, faint or prominent, yellowish brown or reddish brown mottles.

Ord Series

The Ord series consists of deep, somewhat poorly drained, moderately rapidly permeable soils formed in stratified alluvium on bottom land. Slopes range from 0 to 2 percent.

The Ord soils in Loup County have a content of calcium carbonate that is lower than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Ord soils are adjacent to Bolent, Cozad, Ipage, and Loup soils. Bolent soils do not have a mollic epipedon. They are in landscape positions similar to those of the Ord soils. Cozad soils are higher on the landscape than the Ord soils and are better drained. Ipage and Loup soils have more sand in the upper part than the Ord soils. Also, Ipage soils are better drained and are higher on the landscape, and Loup soils are poorly drained and are lower on the landscape.

Typical pedon of Ord very fine sandy loam, 0 to 2 percent slopes, 2,350 feet west and 400 feet north of the southeast corner of sec. 18, T. 21 N., R. 18 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; soft, very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

A—5 to 10 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

AC—10 to 15 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; common fine prominent reddish brown (5YR 5/4 moist) mottles; weak medium subangular blocky structure; soft, very friable; slight effervescence; moderately alkaline; clear smooth boundary.

C1—15 to 21 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; common and medium prominent reddish brown (5YR 5/4 moist) mottles; massive; soft, very friable; thin strata of very fine sandy loam; slight effervescence; moderately alkaline; clear smooth boundary.

C2—21 to 44 inches; light gray (10YR 7/2) loamy fine sand, light brownish gray (10YR 6/2) moist; common medium prominent reddish brown (5YR 5/4 moist) mottles; massive; soft, very friable; thin strata of very fine sandy loam and fine sandy loam; slight effervescence; mildly alkaline; clear smooth boundary.

C3—44 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; thin strata of loamy fine sand; moderately alkaline.

The thickness of the mollic epipedon ranges from 8 to 20 inches. Carbonates are at the surface in most pedons.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly very fine sandy loam, but the range includes silt loam, loam, and fine sandy loam. The AC horizon is intermediate in color and texture between the A and C horizons. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is dominantly loamy fine sand, loamy sand, fine sand, or sand, but it is stratified with finer or coarser textured material.

Simeon Series

The Simeon series consists of deep, excessively drained, rapidly permeable soils on stream terraces. These soils formed in sandy alluvium and glacial outwash. Slopes range from 0 to 30 percent.

Simeon soils are commonly adjacent to Boelus and Valentine soils. Boelus soils have loamy material in the control section. They are slightly higher on the landscape than the Simeon soils. Valentine soils have a lower content of sand and coarse sand than the Simeon soils. Also, they are higher on the landscape.

Typical pedon of Simeon sand, 0 to 3 percent slopes, 800 feet south and 2,500 feet east of the northwest corner of sec. 33, T. 22 N., R. 19 W.

A—0 to 6 inches; grayish brown (10YR 5/2) sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; slightly acid; clear smooth boundary.

AC—6 to 10 inches; brown (10YR 5/3) sand, dark brown (10YR 4/3) moist; single grain; loose; slightly acid; clear smooth boundary.

C1—10 to 18 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grain; loose; slightly acid; clear smooth boundary.

C2—18 to 28 inches; very pale brown (10YR 7/3) sand, brown (10YR 5/3) moist; single grain; loose; about 2

Figure 19.—Typical profile of a Tryon loamy fine sand. The upper arrows indicate the surface layer, and the lower arrow indicates the bottom of the transition layer. Depth is marked in feet.

percent gravel, by volume; slightly acid; gradual smooth boundary.

C3—28 to 60 inches; white (10YR 8/2), stratified sand and coarse sand, light gray (10YR 7/2) moist; single grain; loose; reddish brown (5YR 5/4) iron stains; about 3 percent gravel, by volume; slightly acid.

The thickness of the solum ranges from 7 to 20 inches. The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 or 2. It is dominantly sand, but the range includes fine sand, loamy sand, and sandy loam. The AC horizon has value of 4 to 6 (4 or 5 moist) and chroma of 2 or 3. It has the same textures as the A horizon. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 to 4. It is dominantly sand or coarse sand but commonly has thin strata of gravelly coarse sand. The content of gravel in this horizon is as much as 15 percent, by volume.

Tryon Series

The Tryon series consists of deep, poorly drained and very poorly drained, rapidly permeable soils formed in sandy eolian and alluvial material in sandhill valleys (fig. 19). Slopes range from 0 to 2 percent.

Tryon soils are similar to Almeria soils and are commonly adjacent to Els, Ipage, Marlake, and Valentine soils. Almeria soils are stratified with loamy material. They are on bottom land along streams. Els and Ipage soils are higher on the landscape than the Tryon soils and are better drained. Marlake soils are lower on the landscape than the Tryon soils and are wet for longer periods. Valentine soils are on dunes and are excessively drained.

Typical pedon of Tryon loamy fine sand, wet, 0 to 2 percent slopes, 1,250 feet south and 1,200 feet west of the northeast corner of sec. 29, T. 24 N., R. 17 W.

A—0 to 5 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

AC—5 to 12 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; common distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; slightly acid; clear smooth boundary.

C—12 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; slightly acid.

The thickness of the solum ranges from 3 to 15 inches. The soils generally do not have free carbonates, but in some pedons they are calcareous in the upper few inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes fine sand and loamy sand. This horizon is 3 to 9 inches thick. The AC horizon has value

of 5 to 7 (4 or 5 moist) and chroma of 1 or 2. It is fine sand, loamy sand, or loamy fine sand. The C horizon has hue of 10YR or 2.5Y, value of 5 to 8 (4 to 7 moist), and chroma of 1 to 3. It is dominantly fine sand or sand. In some pedons, however, strata of finer textured material are below a depth of 40 inches. The AC and C horizons have few to many, fine to coarse, distinct or prominent mottles.

Uly Series

The Uly series consists of deep, well drained, moderately permeable soils formed in loess on uplands. Slopes range from 6 to 17 percent.

Uly soils are commonly adjacent to Coly and Hobbs soils. Coly soils do not have a mollic epipedon or a B horizon. They are in landscape positions similar to those of the Uly soils. Hobbs soils are stratified. They are on bottom land along drainageways.

Typical pedon of Uly silt loam, 11 to 17 percent slopes, 2,000 feet west and 200 feet north of the southeast corner of sec. 36, T. 21 N., R. 18 W.

A—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable; neutral; clear smooth boundary.

BA—12 to 18 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; slightly hard, very friable; neutral; clear wavy boundary.

Bw—18 to 28 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; mildly alkaline; clear wavy boundary.

BC—28 to 34 inches, light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

C—34 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 12 to 36 inches. The depth to carbonates ranges from 8 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 3 to 5 (2 or 3 moist). It is dominantly silt loam but in some pedons is very fine sandy loam. The Bw horizon has value of 4 to 7 (2 to 5 moist) and chroma of 2 or 3. It is dominantly silt loam but in some pedons is silty clay loam. The C horizon has value of 4 to 8 (4 to 6 moist) and chroma of 2 to 4. It is silt loam or very fine sandy loam.

Uly silt loam, 6 to 11 percent slopes, eroded, has a mollic epipedon that is thinner than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of the soil.

Valentine Series

The Valentine series consists of deep, excessively drained, rapidly permeable soils formed in sandy eolian material on uplands (fig. 20). Slopes range from 0 to 60 percent.

Valentine soils are commonly adjacent to Els, Gates, Hersh, Ipage, and Simeon soils. The adjacent soils are lower on the landscape than the Valentine soils. Els soils are somewhat poorly drained. Gates and Hersh soils have more silt and less sand than the Valentine soils. Ipage soils are moderately well drained. Simeon soils have a higher content of sand and coarse sand than the Valentine soils.

Typical pedon of Valentine fine sand, rolling, 2,600 feet east and 125 feet north of the southwest corner of sec. 26, T. 22 N., R. 18 W.

A—0 to 4 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; slightly acid; clear smooth boundary.

AC—4 to 9 inches; pale brown (10YR 6/3) fine sand, dark brown (10YR 4/3) moist; single grain; loose; slightly acid; clear smooth boundary.

C—9 to 60 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grain; loose; slightly acid.

The texture is dominantly fine sand throughout the profile, but the range includes sand, loamy sand, and loamy fine sand, which have less than 35 percent sand and less than 10 percent coarse or very coarse sand.

The A horizon has value of 4 to 6 (3 to 5 moist). It is 2 to 9 inches thick. The AC horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 to 4.

Vetal Series

The Vetal series consists of deep, well drained, moderately rapidly permeable soils formed in loamy alluvium and eolian sediments on stream terraces. Slopes are 0 to 1 percent.

Vetal soils are commonly adjacent to Valentine and

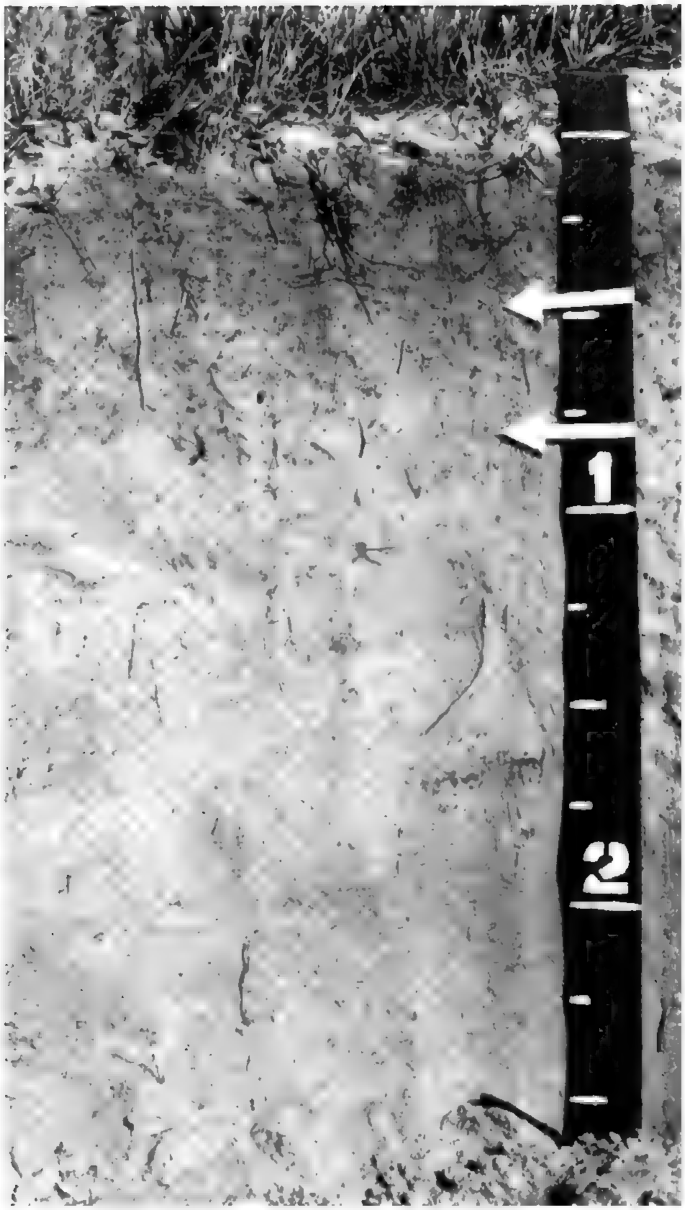

Figure 20.—Typical profile of a Valentine fine sand. The arrow indicates the transition layer. Depth is marked in feet.

Hersh soils. The adjacent soils do not have a mollic epipedon. They are higher on the landscape than the Vetal soils. Also, Valentine soils contain more sand.

Typical pedon of Vetal loam, 0 to 1 percent slopes, 2,500 feet south and 200 feet east of the northwest corner of sec. 31, T. 23 N., R. 20 W.

Ap—0 to 7 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; medium acid; abrupt smooth boundary.

A1—7 to 19 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium and fine granular structure; soft, very friable; neutral; gradual smooth boundary.

A2—19 to 30 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

Ab—30 to 36 inches; dark gray (10YR 4/1) very fine sandy loam, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure; soft, very friable; mildly alkaline; clear smooth boundary.

C—36 to 60 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; mildly alkaline.

The thickness of the solum ranges from 24 to 60 inches. The thickness of the mollic epipedon ranges from 20 to 50 inches. Carbonates generally are below a depth of 60 inches, but they are at a depth of 40 to 60 inches in some pedons.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam, but the range includes fine sandy loam, sandy loam, and loamy very fine sand. The AC horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1 to 3. It is dominantly fine sandy loam, but the range includes very fine sandy loam and loam. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes loam to loamy fine sand.

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are the active factors of soil formation. They act on the parent material that has accumulated and slowly change it into a natural body with genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Climate

Loup County has a subhumid, continental climate characterized by wide seasonal variations in temperature and precipitation. The mean annual temperature is about 49 degrees, and the average annual rainfall is about 22 inches. The average growing season is about 150 days.

Climate indirectly affects soil formation through its effect on the kind and amount of vegetation, microorganisms, and animal life on and in the soil. As the plants and animals decompose, they add organic matter and plant nutrients to the soil.

Rainfall, temperature, and wind directly affect soil formation. Rainfall moves through the soil, dissolving some of the minerals and leaching nutrients, lime, and soluble salts downward. It also breaks down and moves the soil material. It has dissected the loess hills and the broad terraces along the rivers in the county. Alternating periods of freezing and thawing and of wetting and drying accelerate the mechanical weathering of the parent material. They also improve the physical condition of the soil by loosening and mixing the material. Wind action moves the soil material from place to place. It formed the sandhills in the northern part of the county and the comparatively older loess hills in the southern part.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It is largely responsible for the chemical and mineralogical composition of the soil. The soils in Loup County formed in sandy eolian material, in loess, and in alluvium.

The majority of soils in the county formed in sandy eolian material. More than 50 percent of the sandy material is fine sand. The content of coarse sand or particles as fine as silt is as much as 10 percent only in a few areas. The mineralogy of the sand is mixed. Quartz and feldspar are the dominant minerals. Weathering of the sandy material is very slow, and most of the soils are not well developed. Wind action has shifted the material, forming rolling and hilly dunes, especially in areas of Valentine soils. In the swales and valleys between the sandhills, the content of silt and clay is slightly higher than is typical on the hills and dunes. Ipage soils are the main soils in the dry valleys, and Els, Elsmere, and Tryon are the main soils in the wet valleys.

The soils in the southern part of the county formed in Peoria loess that is deeply dissected by drainageways. This material ranges from several feet to several hundred feet in thickness. It is generally calcareous. Uly and Coly soils formed in this loess. Unlike Coly soils, Uly soils have a developed profile.

Between the area of Peoria loess and the sandhills is an area of mixed loess and sandy material. The loess

was geologically eroded, reworked, and redeposited during the period when the sandhills were formed. The resulting parent material is silt loam to fine sandy loam, has a higher content of very fine sand than the Peoria loess, and in places has lenses of sand. Soils formed in this material are not well developed. Hersh and Gates soils formed in loamy eolian material. Scattered low hills and dunes are throughout this transitional area.

The alluvium in the county is water-deposited material on bottom land and stream terraces along the North Loup River, the Calamus River, and their tributaries. The alluvium contains varying amounts of sand, silt, clay, and gravel. The soils that formed in alluvium do not show significant evidence of profile development. They are highly stratified and are well drained to very poorly drained. Some are subject to flooding. Almeria, Bolent, and Ord soils formed in loamy and sandy alluvium on bottom land. Cozad and Hord soils formed in silty alluvium on the higher stream terraces. They are characterized by somewhat more profile development than the soils on bottom land. Simeon soils formed in sandy alluvium on stream terraces. They show no evidence of profile development.

Plant and Animal Life

Animals and plants living in or on the soil affect the physical and chemical properties of the soil. The kinds and amounts of plants and animals are determined by the other soil-forming factors.

Mid and tall grasses are the main native plants in Loup County. As they die, organic matter is added to the soil. The deep, f berous root system of the grasses improves the porosity and structure of the soil. Improved porosity increases the activity of bacteria and of earthworms and other burrowing animals. The deep roots transport m nerals and plant nutrients to the surface, thus improving fertility. As the plants and animals decompose, humus is added to the soil and plant nutrients are released.

Some bacteria in the soil can take in nitrogen from the air. After the bacteria die, the nitrogen is available to plants. Various micro-organisms decompose plant material and dead animals, forming organic matter, which darkens the surface soil. Earthworms, cicadas, and other burrowing animals help to mix the soil material, increasing the pore space. In the wetter soils, which tend to be cooler than the drier soils, the activity of micro-organisms and animals is less extensive. As a result, the organic matter is broken down more slowly.

Relief

Relief affects soil formation through its effect on drainage, erosion, plant cover, and soil temperature. The slopes in Loup County range from less than 1 percent in the valleys to 60 percent on the steeper dunes and breaks along drainageways. The soils on east- and north-facing slopes have slightly cooler temperatures than those on west- and south-facing slopes.

The horizons in the nearly level and gently sloping soils on the loess uplands are more distinct than those in the steeper soils. They absorb more moisture and are affected by percolation to a greater depth. As a result, lime and plant nutrients are leached to a greater depth. Very steep soils have a thin, light colored surface layer and are only slightly leached. The erosion caused by excessive runoff has restricted the formation of the steep and very steep Coly soils.

Little or no water runs off the surface in the sandhills. The excessively drained soils in these areas have indistinct horizons because the sandy material is highly resistant to chemical weathering. Lime has been leached out of the profile.

Elsmere, Els, Tryon, and other soils on the lower parts of the landscape have a high water table and generally have a dark surface layer that is fairly high in content of organic matter. In some areas they are calcareous or contain soluble salts, which were brought upward through capillary action and were deposited as the soil dried out. The amount of available water also affects the growth of plants and the content of organic matter. Some soils on bottom land are subject to periodic flooding and deposition. As a result, the soils are stratified and show almost no evidence of horizon development. Almeria and Hobbs soils are examples.

Time

Long periods are needed for the formation of a soil. The resistance of the parent material to weathering and the length of time that the parent material has been in place are the main factors that determine the extent of profile development. Soils that have been in place for long periods generally have well expressed horizons.

Soils in the sandhills and on bottom land in Loup County do not have well expressed horizons. Their parent material has not been in place long enough for a mature soil to form. The sandy material in the sandhills is very resistant to weathering. As a result, the rate of soil formation is slow. The sandy material is not very

stable, and soil blowing can remove soil material from one place and deposit it in another. When this process takes place, a new cycle of soil formation begins. Another cycle of soil formation begins when floodwater on bottom land deposits new material over older parent material. Valentine, Almeria, and Bolent soils on bottom land are some of the youngest soils in Loup County.

The loess in the uplands has been in place much longer than the parent material in the sandhills or on the bottom land. As a result, the soils that formed in this silty loess are more mature. The loess is less resistant to weathering than the sandy material. Genetic horizons have had time to develop and a subsoil has formed. Uly soils, which formed in loess, are among the oldest, most mature soils in the county.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month. The amount of forage or feed required to carry one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boot stage. The time in the growth of grasses when the flowering head is in the upper sheaf, just prior to emergence.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Carrying capacity. The maximum stocking rate that can be used without damaging the vegetation or related resources.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen

hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 and 40 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers

especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a

constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Organic matter content. The amount of organic matter

in the soil. The classes of organic matter content used in this survey are very low, less than 0.5 percent; low, 0.5 to 1.0 percent; moderately low, 1.0 to 2.0 percent, moderate, 2.0 to 4.0 percent; and high, 4.0 to 8.0 percent.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Planned grazing system. A system in which two or more units of grazing land are alternately rested and grazed in a planned sequence over a period of years.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. The removal of not more than 50 percent, by weight, of the key management plants when an area of range or pasture is grazed. Proper grazing use protects the surface by maintaining an adequate plant cover. It also maintains or improves the quality and quantity of desirable vegetation.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0

Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey area the classes of slope are—

Nearly level	0 to 2 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 6 percent
Undulating	3 to 9 percent
Strongly sloping	6 to 11 percent
Rolling	9 to 24 percent
Moderately steep	11 to 17 percent
Steep	17 to 30 percent
Hilly	more than 24 percent
Very steep	30 to 60 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stocking rate. The number of livestock per unit of grazing land.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Chambers, Nebraska)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	30.7	7.5	19.1	61	-25	0	0.34	0.10	0.53	1	4.0
February----	36.3	13.3	24.8	70	-17	9	.59	.17	.92	2	6.0
March-------	44.9	21.6	33.3	81	-9	26	1.13	.38	1.74	3	6.7
April-------	61.2	35.1	48.2	91	14	91	2.11	.90	3.12	5	2.3
May---------	71.9	46.6	59.3	94	25	306	3.18	1.78	4.42	7	.1
June--------	81.7	56.3	69.0	102	39	570	3.92	2.24	5.41	7	.0
July--------	87.6	61.4	74.5	104	48	760	2.74	1.21	4.03	6	.0
August------	85.8	59.2	72.5	101	43	698	2.99	1.63	4.18	5	.0
September---	77.1	49.1	63.1	98	29	397	2.07	.85	3.09	4	.0
October-----	66.6	37.3	52.0	91	16	152	1.37	.10	2.28	3	.5
November----	48.8	23.3	36.1	78	-6	11	.57	.04	.96	2	2.7
December----	36.4	13.7	25.1	68	-18	0	.61	.19	.96	2	6.3
Yearly:											
Average---	60.8	35.4	48.1	---	---	---	---	---	---	---	---
Extreme---	---	---	---	105	-25	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,020	21.62	17.40	26.22	47	28.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Chambers, Nebraska)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 1	May 19	May 23
2 years in 10 later than--	Apr. 26	May 13	May 17
5 years in 10 later than--	Apr. 17	Apr. 30	May 5
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 8	Sept. 29	Sept. 17
2 years in 10 earlier than--	Oct. 13	Oct. 4	Sept. 22
5 years in 10 earlier than--	Oct. 22	Oct. 13	Oct. 2

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Chambers, Nebraska)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	168	142	123
8 years in 10	174	150	132
5 years in 10	187	165	148
2 years in 10	199	181	165
1 year in 10	206	189	174

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ab	Almeria loamy fine sand, 0 to 2 percent slopes	380	0.1
Ac	Almeria loamy fine sand, wet, 0 to 2 percent slopes	370	0.1
Ad	Almeria fine sandy loam, channeled	1,760	0.5
Bg	Blownout land-Valentine complex, 6 to 60 percent slopes	1,230	0.3
BhB	Boelus loamy fine sand, sandy substratum, 0 to 3 percent slopes	840	0.2
BkB	Boelus, sandy substratum-Simeon loamy sands, 0 to 3 percent slopes	1,500	0.4
Bo	Bolent loamy fine sand, 0 to 2 percent slopes	1,490	0.4
Cm	Calamus loamy fine sand, 0 to 2 percent slopes	1,810	0.5
CrG	Coly-Hobbs silt loams, 2 to 60 percent slopes	4,190	1.1
Cs	Cozad silt loam, 0 to 1 percent slopes	1,910	0.5
CsB	Cozad silt loam, 1 to 3 percent slopes	1,650	0.4
Eb	Els loamy sand, 0 to 2 percent slopes	730	0.2
EfB	Els-Ipage fine sands, 0 to 3 percent slopes	6,520	1.9
Em	Elsmere loamy fine sand, 0 to 2 percent slopes	1,130	0.3
Fu	Fluvaquents, sandy	630	0.2
GfB	Gates silt loam, 1 to 3 percent slopes	1,430	0.4
GfC2	Gates silt loam, 3 to 6 percent slopes, eroded	2,690	0.7
GfD	Gates silt loam, 6 to 11 percent slopes	1,550	0.4
GfF	Gates silt loam, 11 to 30 percent slopes	1,230	0.3
HeB	Hersh fine sandy loam, 0 to 3 percent slopes	1,360	0.4
HeC	Hersh fine sandy loam, 3 to 6 percent slopes	3,640	1.0
HeD	Hersh fine sandy loam, 6 to 11 percent slopes	1,950	0.5
HfB	Hersh-Gates complex, 0 to 3 percent slopes	4,600	1.3
HfG	Hersh-Gates complex, 20 to 60 percent slopes	2,360	0.6
HgF	Hersh-Valentine complex, 9 to 24 percent slopes	2,680	0.7
Hm	Hobbs silt loam, channeled	250	0.1
Ht	Hord silt loam, 0 to 1 percent slopes	2,320	0.6
IfB	Ipage fine sand, 0 to 3 percent slopes	5,850	1.6
IhB	Ipage fine sand, terrace, 0 to 3 percent slopes	6,940	1.9
ImB	Ipage loamy fine sand, terrace, 0 to 3 percent slopes	3,150	0.9
Lp	Loup fine sandy loam, 0 to 2 percent slopes	470	0.1
Ma	Marlake loamy fine sand, 0 to 2 percent slopes	510	0.1
Or	Ord very fine sandy loam, 0 to 2 percent slopes	1,910	0.5
Pb	Pits and dumps	140	*
SmB	Simeon sand, 0 to 3 percent slopes	1,870	0.5
SmF	Simeon sand, 3 to 30 percent slopes	340	0.1
To	Tryon loamy fine sand, 0 to 2 percent slopes	1,020	0.3
Tp	Tryon loamy fine sand, wet, 0 to 2 percent slopes	1,900	0.5
TsB	Tryon-Els loamy fine sands, 0 to 2 percent slopes	2,250	0.6
TtB	Tryon-Ipage complex, 0 to 3 percent slopes	4,770	1.3
UbD2	Uly silt loam, 6 to 11 percent slopes, eroded	330	0.1
UbE	Uly silt loam, 11 to 17 percent slopes	970	0.3
VaD	Valentine fine sand, 3 to 9 percent slopes	17,370	4.8
VaE	Valentine fine sand, rolling	91,610	24.9
VaF	Valentine fine sand, rolling and hilly	153,060	41.8
VeB	Valentine loamy fine sand, 0 to 3 percent slopes	1,590	0.4
VeD	Valentine loamy fine sand, 3 to 9 percent slopes	5,830	1.6
VmD	Valentine-Els complex, 0 to 9 percent slopes	5,620	1.5
VsD	Valentine-Simeon complex, 0 to 9 percent slopes	1,330	0.4
Vt	Vetal loam, 0 to 1 percent slopes	420	0.1
	Water areas more than 40 acres in size	5,942	1.6
	Total	367,392	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland)

Map symbol	Soil name
Cs	Cozad silt loam, 0 to 1 percent slopes
CsB	Cozad silt loam, 1 to 3 percent slopes
GfB	Gates silt loam, 1 to 3 percent slopes
GfC2	Gates silt loam, 3 to 6 percent slopes, eroded
HeB	Hersh fine sandy loam, 0 to 3 percent slopes
HeC	Hersh fine sandy loam, 3 to 6 percent slopes
HfB	Hersh-Gates complex, 0 to 3 percent slopes
Ht	Hord silt loam, 0 to 1 percent slopes
Or	Ord very fine sandy loam, 0 to 2 percent slopes
Vt	Vetal loam, 0 to 1 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability		Corn		Grain sorghum		Winter wheat		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
Ab, Ac: Almeria	Vw	---	---	---	---	---	---	---	---	---
Ad: Almeria	VIw	---	---	---	---	---	---	---	---	---
Bg: Blownout land-Valentine	VIIe	---	---	---	---	---	---	---	---	---
BhB: Boelus	IIIe	IIIe	35	130	40	100	22	---	2.4	5.0
BkB: Boelus-Simeon	VIe	IVe	---	115	---	---	---	---	---	4.1
Bo: Bolent	IVw	IVw	---	---	---	---	---	---	2.3	---
Cm: Calamus	VIe	IVe	---	85	---	---	---	---	---	3.2
CrG: Coly-Hobbs	VIIe	---	---	---	---	---	---	---	---	---
Cs: Cozad	IIc	I	50	145	58	120	43	---	3.8	6.5
CsB: Cozad	IIe	IIe	47	140	55	115	40	---	3.5	6.2
Eb: Els	IVw	IVw	30	115	32	75	18	---	2.0	4.0
EfB: Els-Ipage	VIe	IVe	---	105	---	---	---	---	---	3.9
Em: Elsmere	IVw	IVw	40	120	40	80	---	---	2.5	4.2
Fu: Fluvaquents	VIIIw	---	---	---	---	---	---	---	---	---
GfB: Gates	IIe	IIe	40	130	45	110	40	---	3.3	5.5
GfC2: Gates	IIIe	IIIe	35	120	42	95	33	---	2.3	5.0
GfD: Gates	IVe	IVe	25	105	27	82	25	---	1.4	3.8
GfF: Gates	VIe	---	---	---	---	---	---	---	---	---
HeB: Hersh	IIIe	IIe	38	122	44	100	33	---	2.0	4.6

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Grain sorghum		Winter wheat		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
HeC: Hersh	IIIe	IIIe	34	115	36	95	27	---	1.8	4.4
HeD: Hersh	IVe	IVe	26	105	28	85	20	---	1.5	3.8
HfB: Hersh-Gates	IIIe	IIe	39	125	44	105	35	---	2.1	4.9
HfG: Hersh-Gates	VIIe	---	---	---	---	---	---	---	---	---
HgF: Hersh-Valentine	VIe	---	---	---	---	---	---	---	---	---
Hm: Hobbs	VIw	---	---	---	---	---	---	---	---	---
Ht: Hord	IIc	I	52	150	62	125	43	---	3.8	6.5
IfB, IhB: Ipage	VIe	IVe	---	105	---	---	---	---	---	3.9
ImB: Ipage	IVe	IVe	25	120	30	85	16	---	1.2	4.1
Lp: Loup	Vw	---	---	---	---	---	---	---	---	---
Ma: Marlake	VIIIw	---	---	---	---	---	---	---	---	---
Or: Ord	IIw	IIw	58	130	55	110	32	---	3.8	5.7
Pb*: Pits and dumps	VIIIs	---	---	---	---	---	---	---	---	---
SmB: Simeon	VIs	IVs	---	100	---	---	---	---	---	3.0
SmF: Simeon	VIs	---	---	---	---	---	---	---	---	---
To, Tp: Tryon	Vw	---	---	---	---	---	---	---	---	---
TsB: Tryon-Els	Vw	---	---	---	---	---	---	---	---	---
TtB: Tryon-Ipage	Vw	---	---	---	---	---	---	---	---	---
UbD2: Uly	IVe	IVe	26	105	28	70	22	---	1.5	4.0
UbE: Uly	VIe	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Grain sorghum		Winter wheat		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
VaD------------------ Valentine	VIe	IVe	---	90	---	55	---	---	---	3.5
VaE------------------ Valentine	VIe	---	---	---	---	---	---	---	---	---
VaF------------------ Valentine	VIIe	---	---	---	---	---	---	---	---	---
VeB------------------ Valentine	IVe	IVe	25	120	28	85	15	---	1.0	3.6
VeD------------------ Valentine	VIe	IVe	---	110	---	65	---	---	---	3.3
VmD------------------ Valentine-Els	VIe	IVe	---	105	---	---	---	---	---	3.0
VsD------------------ Valentine-Simeon	VIe	IVe	---	95	---	---	---	---	---	3.0
Vt------------------- Vetal	IIc	I	50	145	60	120	42	---	3.5	6.2

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class		Total acreage	Major management concerns (Subclass)			
			Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
			Acres	Acres	Acres	Acres
I	(N)	---	---	---	---	---
	(I)	4,650	---	---	---	---
II	(N)	9,640	3,080	1,910	---	4,650
	(I)	10,950	9,040	1,910	---	---
III	(N)	13,130	13,130	---	---	---
	(I)	7,170	7,170	---	---	---
IV	(N)	11,920	8,570	3,350	---	---
	(I)	66,560	61,340	3,350	1,870	---
V	(N)	11,160	---	11,160	---	---
VI	(N)	153,480	149,260	2,010	2,210	---
VII	(N)	160,840	160,840	---	---	---
VIII	(N)	1,140	---	1,140	---	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ab: Almeria	Wet Subirrigated	Favorable	5,700	Prairie cordgrass	25
		Normal	5,200	Switchgrass	20
		Unfavorable	4,700	Big bluestem	20
				Reedgrass	15
				Sedge	10
Ac: Almeria	Wetland	Favorable	5,800	Prairie cordgrass	30
		Normal	5,400	Northern reedgrass	15
		Unfavorable	5,000	Sedge	15
				Bluejoint reedgrass	15
				Rush	10
				Slender wheatgrass	5
Bg*: Blownout land.					
Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Needleandthread	10
				Sand lovegrass	5
				Blue grama	5
BhB: Boelus	Sandy	Favorable	3,500	Little bluestem	20
		Normal	3,300	Prairie sandreed	20
		Unfavorable	3,000	Sand bluestem	15
				Needleandthread	10
				Switchgrass	10
				Blue grama	5
				Sedge	5
BkB*:					
Boelus	Sandy	Favorable	3,500	Little bluestem	20
		Normal	3,300	Prairie sandreed	20
		Unfavorable	3,000	Sand bluestem	15
				Needleandthread	10
				Switchgrass	10
				Blue grama	5
				Sedge	5
Simeon	Shallow to Gravel	Favorable	1,800	Blue grama	20
		Normal	1,600	Prairie sandreed	15
		Unfavorable	1,100	Needleandthread	15
				Sand bluestem	10
				Little bluestem	10
				Clubmoss	10
				Hairy grama	5
				Sand dropseed	5
Bo: Bolent	Subirrigated	Favorable	5,500	Big bluestem	30
		Normal	5,000	Indiangrass	15
		Unfavorable	4,200	Little bluestem	15
				Prairie cordgrass	10
				Switchgrass	10
				Sedge	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Cm: Calamus	Sandy	Favorable	2,600	Sand bluestem	30
		Normal	2,200	Little bluestem	20
		Unfavorable	1,600	Prairie sandreed	15
				Switchgrass	10
				Needleandthread	10
				Sedge	5
				Indiangrass	5
CrG*:					
Coly	Thin Loess	Favorable	2,800	Little bluestem	35
		Normal	2,600	Big bluestem	20
		Unfavorable	2,400	Sideoats grama	10
				Plains muhly	5
				Sedge	5
				Indiangrass	5
				Switchgrass	5
Hobbs	Silty Overflow	Favorable	4,500	Big bluestem	30
		Normal	4,000	Western wheatgrass	20
		Unfavorable	3,800	Little bluestem	15
				Switchgrass	10
				Sideoats grama	5
				Sedge	5
Cs, CsB: Cozad	Silty Lowland	Favorable	4,500	Big bluestem	30
		Normal	4,200	Little bluestem	20
		Unfavorable	3,800	Western wheatgrass	15
				Sideoats grama	10
				Blue grama	5
				Sedge	5
Eb: Els	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5
EfB*:					
Els	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5
Ipage	Sandy Lowland	Favorable	3,500	Sand bluestem	25
		Normal	3,200	Little bluestem	20
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Indiangrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Em: Elsmere	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	20
		Unfavorable	5,000	Indiangrass	10
				Switchgrass	5
				Prairie cordgrass	5
				Sedge	5
				Plains bluegrass	5
GfB, GfC2, GfD, GfF: Gates	Silty	Favorable	3,700	Big bluestem	30
		Normal	3,200	Little bluestem	15
		Unfavorable	2,700	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Blue grama	5
				Needleandthread	5
				Sedge	5
				Leadplant	5
HeB, HeC, HeD: Hersh	Sandy	Favorable	3,500	Sand bluestem	30
		Normal	3,300	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Switchgrass	5
HfB*, HfG*:					
Hersh	Sandy	Favorable	3,500	Sand bluestem	30
		Normal	3,300	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Switchgrass	5
Gates	Silty	Favorable	3,700	Big bluestem	30
		Normal	3,200	Little bluestem	15
		Unfavorable	2,700	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Blue grama	5
				Needleandthread	5
				Sedge	5
				Leadplant	5
HgF*:					
Hersh	Sandy	Favorable	3,500	Sand bluestem	30
		Normal	3,300	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Switchgrass	5
Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Hm----------------- Hobbs	Silty Overflow-----------------	Favorable Normal Unfavorable	4,500 4,000 3,800	Big bluestem------------------- Western wheatgrass------------- Little bluestem---------------- Switchgrass-------------------- Sideoats grama----------------- Sedge--------------------------	30 20 15 10 5 5
Ht----------------- Hord	Silty Lowland------------------	Favorable Normal Unfavorable	4,500 4,200 3,800	Big bluestem------------------- Little bluestem---------------- Switchgrass-------------------- Western wheatgrass------------- Sideoats grama----------------- Blue grama---------------------	30 20 10 10 5 5
IfB---------------- Ipage	Sandy Lowland------------------	Favorable Normal Unfavorable	3,500 3,200 3,000	Sand bluestem------------------ Little bluestem---------------- Prairie sandreed--------------- Needleandthread---------------- Indiangrass-------------------- Sedge-------------------------- Switchgrass-------------------- Blue grama---------------------	25 20 15 10 5 5 5 5
IhB, ImB----------- Ipage	Sandy--------------------------	Favorable Normal Unfavorable	3,000 2,600 2,500	Prairie sandreed--------------- Sand bluestem------------------ Little bluestem---------------- Switchgrass-------------------- Needleandthread---------------- Blue grama--------------------- Sedge-------------------------- Indiangrass--------------------	20 15 10 10 10 5 5 5
Lp----------------- Loup	Wet Subirrigated---------------	Favorable Normal Unfavorable	5,800 5,500 5,300	Switchgrass-------------------- Indiangrass-------------------- Prairie cordgrass-------------- Big bluestem------------------- Plains bluegrass--------------- Northern reedgrass-------------	25 15 15 15 5 5
Or----------------- Ord	Subirrigated-------------------	Favorable Normal Unfavorable	5,500 5,300 5,000	Big bluestem------------------- Little bluestem---------------- Indiangrass-------------------- Switchgrass-------------------- Prairie cordgrass-------------- Plains bluegrass---------------	30 15 15 10 10 5
SmB---------------- Simeon	Shallow to Gravel--------------	Favorable Normal Unfavorable	1,500 1,300 800	Blue grama--------------------- Prairie sandreed--------------- Needleandthread---------------- Sand bluestem------------------ Little bluestem---------------- Clubmoss----------------------- Hairy grama-------------------- Sand dropseed------------------	20 15 15 10 10 10 5 5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
SmF: Simeon	Shallow to Gravel	Favorable	1,400	Blue grama	20
		Normal	1,200	Prairie sandreed	15
		Unfavorable	700	Needleandthread	15
				Sand bluestem	10
				Little bluestem	10
				Clubmoss	10
				Hairy grama	5
				Sand dropseed	5
To: Tryon	Wet Subirrigated	Favorable	5,800	Switchgrass	20
		Normal	5,500	Indiangrass	15
		Unfavorable	5,300	Big bluestem	15
				Prairie cordgrass	10
				Slender wheatgrass	5
				Plains bluegrass	5
Tp: Tryon	Wetland	Favorable	6,000	Prairie cordgrass	25
		Normal	5,800	Northern reedgrass	20
		Unfavorable	5,500	Bluejoint reedgrass	15
				Rush	5
				Slender wheatgrass	5
TsB*:					
Tryon	Wet Subirrigated	Favorable	5,800	Switchgrass	20
		Normal	5,500	Indiangrass	15
		Unfavorable	5,300	Big bluestem	15
				Prairie cordgrass	10
				Slender wheatgrass	5
				Plains bluegrass	5
Els	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5
TtB*:					
Tryon	Wet Subirrigated	Favorable	5,800	Switchgrass	20
		Normal	5,500	Indiangrass	15
		Unfavorable	5,300	Big bluestem	15
				Prairie cordgrass	10
				Slender wheatgrass	5
				Plains bluegrass	5
Ipage	Sandy Lowland	Favorable	3,500	Sand bluestem	25
		Normal	3,200	Little bluestem	20
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Indiangrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5
UbD2, UbE: Uly	Silty	Favorable	3,700	Big bluestem	25
		Normal	3,200	Little bluestem	25
		Unfavorable	2,700	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Sedge	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
VaD, VaE: Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
VaF*:					
Valentine, rolling	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
Valentine, hilly	Choppy Sands	Favorable	2,800	Sand bluestem	20
		Normal	2,400	Prairie sandreed	20
		Unfavorable	2,000	Little bluestem	15
				Switchgrass	10
				Needleandthread	10
				Sand lovegrass	5
				Blue grama	5
				Sandhill muhly	5
VeB: Valentine	Sandy	Favorable	3,300	Sand bluestem	20
		Normal	3,000	Little bluestem	20
		Unfavorable	2,600	Prairie sandreed	20
				Needleandthread	15
				Blue grama	10
				Switchgrass	5
				Sand dropseed	5
VeD: Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
VmD*:					
Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
Els	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo-sition
		Kind of year	Dry weight		
			Lb/acre		Pct
VsD*:					
Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
Simeon	Shallow to Gravel	Favorable	1,500	Blue grama	20
		Normal	1,300	Prairie sandreed	15
		Unfavorable	800	Needleandthread	15
				Sand bluestem	10
				Little bluestem	10
				Clubmoss	10
				Hairy grama	5
				Sand dropseed	5
Vt Vetal	Silty	Favorable	3,500	Little bluestem	25
		Normal	2,800	Needleandthread	10
		Unfavorable	2,000	Prairie sandreed	10
				Blue grama	10
				Sideoats grama	10
				Big bluestem	10
				Switchgrass	5
				Western wheatgrass	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ab: Almeria	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Ac, Ad. Almeria					
Bg*: Blownout land.					
Valentine.					
BhB: Boelus	Lilac, Amur honeysuckle, American plum.	Eastern redcedar, Russian olive, common chokecherry, Manchurian crabapple.	Hackberry, ponderosa pine, green ash, honeylocust.	Siberian elm	---
BkB*: Boelus	Lilac, Amur honeysuckle, American plum.	Eastern redcedar, Russian olive, common chokecherry, Manchurian crabapple.	Hackberry, ponderosa pine, green ash, honeylocust.	Siberian elm	---
Simeon.					
Bo: Bolent	American plum, lilac, Siberian peashrub.	Manchurian crabapple.	Eastern redcedar, ponderosa pine, hackberry, green ash.	Golden willow, honeylocust.	Eastern cottonwood.
Cm: Calamus	---	Eastern redcedar, Rocky Mountain juniper.	Scotch pine, jack pine, ponderosa pine, Austrian pine.	---	---
CrG*: Coly.					
Hobbs	American plum	Amur honeysuckle, lilac, Siberian peashrub.	Eastern redcedar, Austrian pine, ponderosa pine, green ash, Russian mulberry.	Hackberry, honeylocust.	Eastern cottonwood.
Cs, CsB: Cozad	American plum	Lilac, Amur honeysuckle.	Eastern redcedar, Austrian pine, Russian olive, ponderosa pine, green ash, Russian mulberry.	Hackberry, honeylocust.	Eastern cottonwood.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Eb: Els	Lilac	Common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.
EfB*:					
Els	Lilac	Common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.
Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Em: Elsmere	Lilac	Common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, Manchurian crabapple, hackberry, ponderosa pine.	Honeylocust, golden willow.	Eastern cottonwood.
Fu. Fluvaquents					
GfB, GfC2, GfD: Gates	Amur honeysuckle, fragrant sumac, lilac.	Russian mulberry	Green ash, honeylocust, Russian olive, eastern redcedar, bur oak, ponderosa pine, hackberry.	Siberian elm	---
GfF. Gates					
HeB, HeC, HeD: Hersh	Lilac, American plum.	Common chokecherry	Eastern redcedar, honeylocust, hackberry, ponderosa pine, green ash, Russian mulberry, Scotch pine, Austrian pine.	Siberian elm	---
HfB*:					
Hersh	Lilac, American plum.	Common chokecherry	Eastern redcedar, honeylocust, hackberry, ponderosa pine, green ash, Russian mulberry, Scotch pine, Austrian pine.	Siberian elm	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
HfB*: Gates	Amur honeysuckle, fragrant sumac, lilac.	Russian mulberry	Green ash, honeylocust, Russian olive, eastern redcedar, bur oak, ponderosa pine, hackberry.	Siberian elm	---
HfG*: Hersh.					
Gates.					
HgF*: Hersh.					
Valentine.					
Hm. Hobbs					
Ht Hord	Peking cotoneaster	Lilac, Siberian peashrub, American plum.	Eastern redcedar, ponderosa pine, blue spruce, Manchurian crabapple.	Golden willow, green ash, hackberry.	Eastern cottonwood.
IfB Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
IhB Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, jack pine, Scotch pine, Austrian pine.	---	---
ImB Ipage	---	Eastern redcedar, Rocky Mountain juniper, lilac, American plum, skunkbush sumac.	Austrian pine, jack pine, ponderosa pine, honeylocust, green ash, hackberry.	Siberian elm	---
Lp Loup	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Ma. Marlake					
Or Ord	Lilac, American plum.	Common chokecherry.	Eastern redcedar, ponderosa pine, Russian mulberry, green ash, hackberry.	Honeylocust, golden willow.	Eastern cottonwood.
Pb*. Pits and dumps					
SmB, SmF. Simeon					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
To: Tryon	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Tp. Tryon					
TsB*: Tryon	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Els	Lilac	Common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.
TtB*: Tryon	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
UbD2, UbE: Uly	Amur honeysuckle, lilac.	Common chokecherry, Russian mulberry.	Eastern redcedar, green ash, Russian olive, honeylocust, Austrian pine, hackberry, bur oak.	Siberian elm	---
VaD, VaE: Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
VaF*: Valentine, rolling.					
Valentine, hilly.					
VeB: Valentine	Lilac, skunkbush sumac.	Eastern redcedar, Russian olive, Manchurian crabapple, Siberian peashrub.	Hackberry, ponderosa pine, green ash, honeylocust.	Siberian elm	---
VeD: Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
VmD*: Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
VmD*:					
Els	Lilac	Common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.
VsD*:					
Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Simeon.					
Vt Vetal	Lilac	Eastern redcedar, Rocky Mountain juniper, common chokecherry, Russian olive, Siberian peashrub.	Hackberry, ponderosa pine, honeylocust, green ash.	Siberian elm	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ab: Almeria	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ac: Almeria	Severe: flooding, ponding.	Severe: ponding.		Severe: ponding.
Ad: Almeria	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.
Bg*: Blownout land.				
Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
BhB: Boelus	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
BkB*: Boelus	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Simeon	Slight	Slight	Slight	Slight.
Bo: Bolent	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.
Cm: Calamus	Severe: flooding.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
CrG*: Coly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
Hobbs	Severe: flooding.	Slight	Moderate: slope, flooding.	Slight.
Cs: Cozad	Severe: flooding.	Slight	Slight	Slight.
CsB: Cozad	Severe: flooding.	Slight	Moderate: slope.	Slight.
Eb: Els	Severe: flooding.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
EfB*:				
Els	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Em. Elsmere	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Fu. Fluvaquents				
GfB, GfC2 Gates	Slight	Slight	Moderate: slope.	Severe: erodes easily.
GfD Gates	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
GfF Gates	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
HeB Hersh	Slight	Slight	Slight	Slight.
HeC Hersh	Slight	Slight	Moderate: slope.	Slight.
HeD Hersh	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
HfB*:				
Hersh	Slight	Slight	Slight	Slight.
Gates	Slight	Slight	Slight	Severe: erodes easily.
HfG*:				
Hersh	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gates	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
HgF*:				
Hersh	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Valentine	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.
Hm Hobbs	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Ht Hord	Severe: flooding.	Slight	Slight	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
IfB, IhB: Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
ImB: Ipage	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Lp: Loup	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ma: Marlake	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Or: Ord	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Pb*. Pits and dumps				
SmB: Simeon	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
SmF: Simeon	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
To: Tryon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Tp: Tryon	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
TsB*:				
Tryon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Els	Severe: flooding.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.
TtB*:				
Tryon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
UbD2, UbE: Uly	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
VaD: Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VaE: Valentine	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
VaF*: Valentine	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VeB: Valentine	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
VeD: Valentine	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
VmD*:				
Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Els	Severe: flooding.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.
VsD*:				
Valentine	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
Simeon	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Vt: Vetal	Slight	Slight	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ab: Almeria	Poor	Fair	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Ac, Ad: Almeria	Very poor.	Poor	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	Poor.
Bg*: Blownout land.												
Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
BhB: Boelus	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
BkB*: Boelus	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Simeon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Bo: Bolent	Poor	Fair	Good	Good	Good	Good	Fair	Very poor.	Fair	Good	Poor	Good.
Cm: Calamus	Poor	Good	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Fair.
CrG*: Coly	Very poor.	Very poor.	Poor	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Hobbs	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Cs, CsB: Cozad	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Eb: Els	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
EfB*: Els	Poor	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.
Ipage	Poor	Good	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Poor	Fair.
Em: Elsmere	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.
Fu. Fluvaquents												
GfB: Gates	Good	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
GfC2, GfD: Gates	Fair	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
GfF----------------- Gates	Poor	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
HeB, HeC, HeD------ Hersh	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
HfB*:												
Hersh-------------	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Gates-------------	Good	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
HfG*:												
Hersh-------------	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
Gates-------------	Poor	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
HgF*:												
Hersh-------------	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
Valentine---------	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Hm----------------- Hobbs	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Ht----------------- Hord	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
IfB---------------- Ipage	Poor	Good	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Fair.
IhB---------------- Ipage	Fair	Good	Fair	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor	Good.
ImB---------------- Ipage	Poor	Good	Fair	Poor	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Good.
Lp----------------- Loup	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Ma----------------- Marlake	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
Or----------------- Ord	Good	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good.
Pb*. Pits and dumps												
SmB---------------- Simeon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
SmF---------------- Simeon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hard-wood trees	Conif-erous plants	Shrubs	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life	Range-land wild-life
To, Tp-------------Tryon	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
TsB*:												
Tryon-------------	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Els---------------	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
TtB*:												
Tryon-------------	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Ipage-------------	Poor	Good	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Poor	Fair.
UbD2---------------Uly	Fair	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
UbE----------------Uly	Poor	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
VaD, VaE-----------Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VaF*---------------Valentine	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VeB----------------Valentine	Fair	Good	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VeD----------------Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VmD*:												
Valentine---------	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Els---------------	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
VsD*:												
Valentine---------	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Simeon------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Vt-----------------Vetal	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ab---------------- Almeria	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness.
Ac---------------- Almeria	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding.
Ad---------------- Almeria	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding, flooding.
Bg*: Blowout land.						
Valentine--------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
BhB--------------- Boelus	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
BkB*: Boelus-----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
Simeon-----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
Bo---------------- Bolent	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: wetness, droughty, flooding.
Cm---------------- Calamus	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: droughty.
CrG*: Coly-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hobbs------------	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Cs, CsB----------- Cozad	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
Eb---------------- Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
EfB*:						
Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.
Em Elsmere	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Fu. Fluvaquents						
GfB Gates	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
GfC2 Gates	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
GfD Gates	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
GfF Gates	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HeB Hersh	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
HeC Hersh	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
HeD Hersh	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
HfB*:						
Hersh	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
Gates	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
HfC*:						
Hersh	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gates	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HgF*:						
Hersh	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
HgF*:						
Valentine	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hm: Hobbs	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
Ht: Hord	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
IfB, IhB, TmB: Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.
Lp: Loup	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness.
Ma: Marlake	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Or: Ord	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: frost action.	Moderate: wetness.
Pb*. Pits and dumps						
SmB: Simeon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
SmF: Simeon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
To: Tryon	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Tp: Tryon	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.
TsB*:						
Tryon	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
TtB*:						
Tryon	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
TtB*:						
Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.
UbD2, UbE: Uly	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
VaD: Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VaE, VaF*: Valentine	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VeB: Valentine	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
VeD: Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VmD*:						
Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
VsD*:						
Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Simeon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
Vt: Vetal	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ab------------------ Almeria	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Ac, Ad-------------- Almeria	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, ponding.
Bg*: Blownout land.					
Valentine----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
BhB----------------- Boelus	Severe: percs slowly.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
BkB*: Boelus-------------	Severe: percs slowly.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Simeon-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Bo------------------ Bolent	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
Cm------------------ Calamus	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
CrG*: Coly---------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hobbs--------------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Cs------------------ Cozad	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
CsB----------------- Cozad	Moderate: flooding.	Moderate: seepage, slope.	Moderate: flooding.	Moderate: flooding.	Good.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Eb----------------- Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
EfB*:					
Els----------------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Ipage--------------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Em----------------- Elsmere	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Fu. Fluvaquents					
GfB, GfC2----------- Gates	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too sandy.	Slight-----------	Good.
GfD---------------- Gates	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too sandy.	Moderate: slope.	Fair: slope.
GfF---------------- Gates	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
HeB, HeC----------- Hersh	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
HeD---------------- Hersh	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
HfB*:					
Hersh--------------	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Gates--------------	Moderate: percs slowly.	Moderate: seepage.	Moderate: too sandy.	Slight-----------	Good.
HfC*:					
Hersh--------------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Gates--------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
HgF*:					
Hersh--------------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HgF*:					
Valentine	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Hm Hobbs	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Ht Hord	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
IfB Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
IhB, ImB Ipage	Severe: wetness, poor filter.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Lp Loup	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Ma Marlake	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Or Ord	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Pb*. Pits and dumps					
SmB Simeon	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
SmF Simeon	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
To Tryon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Tp Tryon	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
TsB*:					
Tryon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
TtB*:					
Tryon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
UbD2, UbE Uly	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
VaD Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VaE, VaF* Valentine	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
VeB, VeD Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VmD*:					
Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
VsD*:					
Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Simeon	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Vt Vetal	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ab, Ac, Ad Almeria	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Bg*: Blownout land.				
Valentine	Good	Probable	Improbable: too sandy.	Poor: too sandy.
BhB Boelus	Good	Probable	Improbable: too sandy.	Poor: thin layer.
BkB*: Boelus	Good	Probable	Improbable: too sandy.	Poor: thin layer.
Simeon	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
Bo Bolent	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Cm Calamus	Good	Probable	Probable	Poor: too sandy.
CrG*: Coly	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Hobbs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Cs, CsB Cozad	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Eb Els	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
EfB*: Els	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Ipage	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Em Elsmere	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
GfB, GfC2 Gates	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
GfD: Gates	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
GfF: Gates	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HeB, HeC: Hersh	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
HeD: Hersh	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
HfB*:				
Hersh	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Gates	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
HfG*:				
Hersh	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Gates	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HgF*:				
Hersh	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Valentine	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Hm: Hobbs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ht: Hord	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
IfB, IhB, ImB: Ipage	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Lp: Loup	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Ma: Marlake	Poor: wetness.	Probable	Improbable: too sandy.	Poor: thin layer, wetness.
Or: Ord	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
SmB: Simeon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
SmF: Simeon	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
To------------------- Tryon	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: wetness.
Tp------------------- Tryon	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: wetness.
TsB*:				
Tryon---------------	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: wetness.
Els-----------------	Fair: wetness.	Probable------------	Improbable: too sandy.	Poor: too sandy.
TtB*:				
Tryon---------------	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: wetness.
Ipage---------------	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
UbD2, UbE------------ Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
VaD------------------ Valentine	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
VaE------------------ Valentine	Fair: slope.	Probable------------	Improbable: too sandy.	Poor: slope, too sandy.
VaF*:				
Valentine, rolling---	Fair: slope.	Probable------------	Improbable: too sandy.	Poor: slope, too sandy.
Valentine, hilly-----	Poor: slope.	Probable------------	Improbable: too sandy.	Poor: slope, too sandy.
VeB, VeD------------- Valentine	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
VmD*:				
Valentine-----------	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
Els-----------------	Fair: wetness.	Probable------------	Improbable: too sandy.	Poor: too sandy.
VsD*:				
Valentine-----------	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
Simeon--------------	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
Vt------------------- Vetal	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "moderate" and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ab: Almeria	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty, rooting depth.
Ac: Almeria	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, flooding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy.	Wetness, droughty, rooting depth.
Ad: Almeria	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, flooding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty, rooting depth.
Bg*: Blownout land.						
Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
BhB: Boelus	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing.	Too sandy, soil blowing.	Favorable.
BkB*: Boelus	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing.	Too sandy, soil blowing.	Favorable.
Simeon	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Bo: Bolent	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
Cm: Calamus	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
CrG*: Coly	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Hobbs	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
Cs, CsB: Cozad	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Eb----------------- Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
EfB*:						
Els---------------	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
Ipage-------------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Em----------------- Elsmere	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
Fu. Fluvaquents						
GfB---------------- Gates	Moderate: seepage.	Severe: piping.	Deep to water	Favorable-------	Erodes easily	Erodes easily.
GfC2--------------- Gates	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope-----------	Erodes easily	Erodes easily.
GfD, GfF----------- Gates	Severe: slope.	Severe: piping.	Deep to water	Slope-----------	Slope, erodes easily.	Slope, erodes easily.
HeB---------------- Hersh	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
HeC---------------- Hersh	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.
HeD---------------- Hersh	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
HfB*:						
Hersh-------------	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
Gates-------------	Moderate: seepage.	Severe: piping.	Deep to water	Favorable-------	Erodes easily	Erodes easily.
HfG*:						
Hersh-------------	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
Gates-------------	Severe: slope.	Severe: piping.	Deep to water	Slope-----------	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
HgF*:						
Hersh	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Hm: Hobbs	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
Ht: Hord	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
IfB, IhB, ImB: Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Lp: Loup	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
Ma: Marlake	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
Or: Ord	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Favorable.
Pb*. Pits and dumps						
SmB: Simeon	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
SmF: Simeon	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
To: Tryon	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty.
Tp: Tryon	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy.	Wetness, droughty.
TsB*:						
Tryon	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
TsB*:						
Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
TtB*:						
Tryon	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty.
Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
UbD2, UbE Uly	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
VaD Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
VaE, VaF* Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
VeB Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
VeD Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
VmD*:						
Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
VsD*:						
Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
VsD*:						
Simeon	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Vt Vetal	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ab--------------- Almeria	0-5	Loamy fine sand	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	50-80	15-55	<20	NP-5
	5-60	Stratified sand to fine sandy loam.	SM, SP-SM, SM-SC	A-2, A-3, A-4	0	90-100	80-100	50-80	5-50	<20	NP-5
Ac--------------- Almeria	0-4	Loamy fine sand	SM, SM-SC	A-2	0	100	100	50-75	15-30	<20	NP-5
	4-60	Stratified sand to fine sandy loam.	SM, SP-SM, SM-SC	A-2, A-3	0	95-100	90-100	50-75	5-30	<20	NP-5
Ad--------------- Almeria	0-4	Fine sandy loam	SM, ML, SM-SC, SC	A-4	0	100	100	70-85	40-55	<25	NP-10
	4-60	Stratified sand to fine sandy loam.	SM, SP-SM, SM-SC	A-2, A-3	0	95-100	90-100	50-75	5-30	<20	NP-5
Bg*: Blownout land.											
Valentine--------	0-3	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	3-60	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
BhB-------------- Boelus	0-14	Loamy fine sand	SM, SM-SC	A-2, A-4	0	100	100	70-100	15-40	<20	NP-5
	14-23	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM, SM-SC	A-2, A-3, A-4	0	100	100	70-90	5-40	<20	NP-5
	23-28	Loam, clay loam, sandy clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-7	0	100	100	80-100	40-90	25-45	5-25
	28-41	Sandy loam, loam	SM, SC, ML, CL	A-4, A-2	0	100	100	70-95	30-90	<25	NP-10
	41-60	Sand, fine sand, loamy sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	95-100	50-85	5-35	<20	NP-5
BkB*: Boelus-----------	0-11	Loamy sand--------	SM, SM-SC	A-2, A-4	0	100	100	70-100	15-40	<20	NP-5
	11-23	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM, SM-SC	A-2, A-3, A-4	0	100	100	70-90	5-40	<20	NP-5
	23-34	Loam, clay loam, sandy clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-7	0	100	100	80-100	40-90	25-45	5-25
	34-54	Sandy loam, loam	SM, SC, ML, CL	A-4, A-2	0	100	100	70-95	30-90	<25	NP-10
	54-60	Sand, fine sand, loamy sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	95-100	50-85	5-35	<20	NP-5
Simeon-----------	0-5	Loamy sand--------	SM, SP-SM	A-2, A-3	0	95-100	90-100	51-95	5-35	<20	NP
	5-60	Sand, coarse sand, loamy sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	90-100	65-100	35-95	0-30	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Bo--------------- Bolent	0-6	Loamy fine sand	SM, SP-SM	A-2, A-3	0	95-100	95-100	60-80	5-25	<20	NP
	6-60	Stratified fine sandy loam to sand.	SM, SP, SP-SM	A-2, A-3, A-1	0	85-100	80-100	40-70	3-35	---	NP
Cm--------------- Calamus	0-5	Loamy fine sand	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-80	5-35	<20	NP-5
	5-14	Fine sand, loamy fine sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	90-100	65-80	3-35	---	NP
	14-55	Stratified loamy sand to coarse sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	80-100	30-90	3-35	---	NP
	55-60	Stratified coarse sand to gravelly coarse sand.	SP-SM, GP-GM, SP, SP	A-1, A-2, A-3	0	40-100	40-90	20-80	3-15	---	NP
CrG*:											
Coly-------------	0-5	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	85-100	20-40	2-15
	5-60	Silt loam, very fine sandy loam, loam.	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
Hobbs------------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	6-60	Silt loam, silty clay loam, very fine sandy loam.	CL, CL-ML, MH	A-4, A-6, A-7	0	100	100	95-100	80-100	25-55	5-25
Cs, CsB---------- Cozad	0-12	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	100	75-100	20-35	2-12
	12-26	Silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-95	20-35	2-12
	26-60	Silt loam, very fine sandy loam, fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	80-100	50-95	20-35	2-12
Eb--------------- Els	0-6	Loamy sand-------	SM	A-2	0	95-100	85-100	60-100	25-35	---	NP
	6-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
EfB*:											
Els--------------	0-6	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	70-100	5-35	---	NP
	6-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
Ipage------------	0-5	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	5-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
Em--------------- Elsmere	0-14	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	70-100	5-35	---	NP
	14-60	Fine sand, loamy fine sand, very fine sandy loam.	SP-SM, SM	A-2, A-3	0	100	100	60-100	5-30	---	NP
Fu. Fluvaquents											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
GfB, GfC2, GfD, GfF-------------- Gates	0-6	Silt loam--------	ML	A-4	0	100	100	95-100	65-100	20-40	NP-10
	6-14	Very fine sandy loam, silt loam.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
	14-60	Very fine sandy loam, silt loam, loamy very fine sand.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
HeB, HeC, HeD---- Hersh	0-6	Fine sandy loam	SM, SC, SM-SC, ML	A-4	0	100	100	85-100	40-75	<25	NP-10
	6-16	Fine sandy loam, loamy very fine sand.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	80-100	40-65	<20	NP-5
	16-60	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, SM-SC	A-4, A-2	0	100	100	80-100	25-50	<20	NP-5
HfB*: Hersh-----------	0-5	Fine sandy loam	SM, SC, SM-SC, ML	A-4	0	100	100	85-100	40-75	<25	NP-10
	5-13	Fine sandy loam, loamy very fine sand.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	80-100	40-65	<20	NP-5
	13-60	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, SM-SC	A-4, A-2	0	100	100	80-100	25-50	<20	NP-5
Gates-----------	0-6	Very fine sandy loam.	ML	A-4	0	100	100	95-100	65-100	20-40	NP-10
	6-13	Very fine sandy loam, silt loam.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
	13-60	Very fine sandy loam, silt loam, loamy very fine sand.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
HfG*: Hersh-----------	0-5	Fine sandy loam	SM, SC, SM-SC, ML	A-4	0	100	100	85-100	40-75	<25	NP-10
	5-11	Fine sandy loam, loamy very fine sand.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	80-100	40-65	<20	NP-5
	11-60	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, SM-SC	A-4, A-2	0	100	100	80-100	25-50	<20	NP-5
Gates-----------	0-5	Silt loam--------	ML	A-4	0	100	100	95-100	65-100	20-40	NP-10
	5-9	Very fine sandy loam.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
	9-60	Very fine sandy loam, silt loam, loamy very fine sand.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
HgF*:											
Hersh	0-4	Fine sandy loam	SM, SC, SM-SC, ML	A-4	0	100	100	85-100	40-75	<25	NP-10
	4-12	Fine sandy loam, loamy very fine sand.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	80-100	40-65	<20	NP-5
	12-60	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, SM-SC	A-4, A-2	0	100	100	80-100	25-50	<20	NP-5
Valentine	0-6	Loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	6-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
Hm Hobbs	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	6-60	Silt loam, silty clay loam, very fine sandy loam.	CL, CL-ML, MH	A-4, A-6, A-7	0	100	100	95-100	80-100	25-55	5-25
Ht Hord	0-18	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-35	3-18
	18-38	Silt loam, silty clay loam, loam.	CL	A-6, A-4	0	100	100	98-100	85-100	25-40	8-23
	38-60	Silt loam, very fine sandy loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	100	85-100	25-40	6-21
IfB Ipage	0-5	Fine sand	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	5-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
IhB Ipage	0-8	Fine sand	SP-SM, SM	A-2, A-3	0	100	100	50-100	5-15	---	NP
	8-15	Sand, fine sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	50-100	5-30	<20	NP-5
	15-60	Coarse sand, sand, fine sand.	SP, SP-SM	A-2, A-3, A-1	0	100	95-100	25-95	2-10	---	NP
ImB Ipage	0-6	Loamy fine sand	SM, SM-SC	A-2	0	100	100	50-100	15-30	<20	NP-5
	6-10	Sand, fine sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	50-100	5-30	<20	NP-5
	10-60	Coarse sand, sand, fine sand.	SP, SP-SM	A-2, A-3, A-1	0	100	95-100	25-95	2-10	---	NP
Lp Loup	0-4	Fine sandy loam	SM, SM-SC	A-2	0	100	100	70-95	20-35	<20	NP-6
	4-60	Fine sand, loamy fine sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	65-100	5-20	---	NP
Ma Marlake	0-6	Loamy fine sand	SM	A-2, A-4	0	100	100	50-85	15-50	---	NP
	6-10	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-4, A-3	0	100	100	50-85	5-50	---	NP
	10-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Or---------------- Ord	0-15	Very fine sandy loam.	ML	A-4	0	100	100	70-100	50-90	20-35	NP-10
	15-44	Fine sandy loam, loamy fine sand, sandy loam.	SM, ML	A-2, A-4	0	95-100	95-100	70-100	30-85	20-35	NP-10
	44-60	Stratified sand to loamy fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	95-100	95-100	50-100	5-30	<20	NP-5
Pb*. Pits and dumps											
SmB, SmF--------- Simeon	0-6	Sand-------------	SM, SP-SM	A-2, A-3	0	95-100	90-100	51-95	5-20	<20	NP
	6-60	Sand, coarse sand, loamy sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	90-100	65-100	35-95	0-30	---	NP
To---------------- Tryon	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	---	NP
	5-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-30	---	NP
Tp---------------- Tryon	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	---	NP
	5-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	50-90	50-90	5-30	---	NP
TsB*: Tryon-----------	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	---	NP
	5-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-30	---	NP
Els--------------	0-6	Loamy fine sand	SM	A-2	0	95-100	85-100	60-100	25-35	---	NP
	6-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
TtE*: Tryon-----------	0-4	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	---	NP
	4-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-30	---	NP
Ipage------------	0-6	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	6-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
UbD2------------- Uly	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	2-15
	6-21	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-15
	21-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15
UbE-------------- Uly	0-12	Silt loam--------	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	2-15
	12-34	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-15
	34-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15
VaD, VaE, VaF*--- Valentine	0-4	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	4-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
VeB, VeD--------- Valentine	0-6	Loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	6-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
VmD*:											
Valentine-------	0-5	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	5-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
Els-------------	0-6	Loamy fine sand	SM	A-2	0	95-100	85-100	60-100	25-35	---	NP
	6-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
VsD*:											
Valentine-------	0-4	Loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	4-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
Simeon----------	0-5	Sand-------------	SM, SP-SM	A-2, A-3	0	95-100	90-100	51-95	5-20	<20	NP
	5-60	Sand, coarse sand, loamy sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	90-100	65-100	35-95	0-30	---	NP
Vt--------------- Vetal	0-19	Loam-------------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	50-65	20-35	NP-12
	19-30	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-100	30-65	20-30	NP-7
	30-60	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-100	30-65	20-30	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Ab: Almeria	0-5	3-10	1.35-1.55	6.0-20	0.10-0.12	6.1-7.8	Low	0.17	5	8	1-2
	5-60	1-10	1.55-1.80	6.0-20	0.05-0.16	6.1-7.8	Low	0.15			
Ac: Almeria	0-4	3-10	1.35-1.55	6.0-20	0.10-0.12	6.1-7.8	Low	0.17	5	8	1-2
	4-60	1-10	1.55-1.80	6.0-20	0.05-0.16	6.1-7.8	Low	0.15			
Ad: Almeria	0-4	5-15	1.30-1.50	0.6-6.0	0.16-0.22	6.1-7.8	Low	0.24	5	8	1-2
	4-60	1-10	1.55-1.80	6.0-20	0.05-0.16	6.1-7.8	Low	0.15			
Bg*: Blownout land.											
Valentine	0-3	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	Low	0.15	5	1	.5-1
	3-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	Low	0.15			
BhB: Boelus	0-14	0-8	1.35-1.55	6.0-20	0.10-0.12	6.1-7.3	Low	0.17	5	2	1-2
	14-23	0-8	1.55-1.75	6.0-20	0.07-0.12	6.1-7.3	Low	0.17			
	23-28	18-35	1.30-1.65	0.6-2.0	0.17-0.19	6.6-7.8	Moderate	0.32			
	28-41	5-20	1.45-1.70	0.6-6.0	0.12-0.19	6.6-7.8	Low	0.24			
	41-60	0-10	1.55-1.80	6.0-20	0.07-0.12	6.6-7.8	Low	0.17			
BkB*: Boelus	0-11	0-8	1.35-1.55	6.0-20	0.10-0.12	6.1-7.3	Low	0.17	5	2	1-2
	11-23	0-8	1.55-1.75	6.0-20	0.07-0.12	6.1-7.3	Low	0.17			
	23-34	18-35	1.30-1.65	0.6-2.0	0.17-0.19	6.6-7.8	Moderate	0.32			
	34-54	5-20	1.45-1.70	0.6-6.0	0.12-0.19	6.6-7.8	Low	0.24			
	54-60	0-10	1.55-1.80	6.0-20	0.07-0.12	6.6-7.8	Low	0.17			
Simeon	0-5	5-12	1.30-1.50	6.0-20	0.08-0.14	6.1-7.8	Low	0.17	5	2	.5-1
	5-60	2-10	1.50-1.70	6.0-20	0.05-0.10	6.1-7.8	Low	0.15			
Bo: Bolent	0-6	3-10	1.40-1.60	6.0-20	0.10-0.12	7.4-8.4	Low	0.17	5	2	1-2
	6-60	1-10	1.50-1.80	6.0-20	0.05-0.10	6.6-8.4	Low	0.15			
Cm: Calamus	0-5	1-10	1.50-1.60	6.0-20	0.06-0.11	5.6-7.8	Low	0.17	5	2	.5-1
	5-14	3-10	1.50-1.60	6.0-20	0.06-0.11	6.1-7.8	Low	0.17			
	14-55	1-10	1.50-1.70	6.0-20	0.02-0.11	6.1-7.8	Low	0.15			
	55-60	1-8	1.50-1.70	>20	0.02-0.07	6.1-7.8	Low	0.10			
CrG*: Coly	0-5	18-24	1.30-1.50	0.6-2.0	0.20-0.24	7.4-8.4	Low	0.43	5	4L	1-2
	5-60	18-24	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	Low	0.43			
Hobbs	0-6	15-27	1.20-1.40	0.6-2.0	0.21-0.24	6.1-7.8	Low	0.32	5	6	2-4
	6-60	15-30	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	Low	0.32			
Cs, CsB: Cozad	0-12	11-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.32	5	6	1-2
	12-26	10-18	1.30-1.40	0.6-2.0	0.17-0.19	6.1-8.4	Low	0.43			
	26-60	8-18	1.20-1.50	0.6-2.0	0.15-0.19	6.6-8.4	Low	0.24			
Eb: Els	0-6	3-10	1.55-1.60	6.0-20	0.08-0.13	6.1-8.4	Low	0.17	5	2	1-2
	6-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-8.4	Low	0.15			
EfB*: Els	0-6	2-8	1.60-1.70	6.0-20	0.07-0.12	6.1-8.4	Low	0.15	5	1	1-2
	6-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-8.4	Low	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
EfE*:											
Ipage-----------	0-5	1-5	1.40-1.50	6.0-20	0.07-0.09	5.1-7.8	Low-----------	0.15	5	1	.5-1
	5-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.1-7.8	Low-----------	0.15			
Em--------------- Elsmere	0-14	3-10	1.55-1.70	6.0-20	0.10-0.12	5.6-8.4	Low-----------	0.17	5	2	1-2
	14-60	0-8	1.50-1.60	6.0-20	0.06-0.11	5.6-8.4	Low-----------	0.17			
Fu. Fluvaquents											
GfB, GfC2, GfD, GfF------------- Gates	0-6	14-17	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	Low-----------	0.37	5	5	.5-1
	6-14	13-15	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
	14-60	14-17	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
HeB, HeC, HeD---- Hersh	0-6	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	Low-----------	0.24	5	3	.5-1
	6-16	8-18	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.3	Low-----------	0.24			
	16-60	10-18	1.20-1.50	2.0-6.0	0.14-0.16	6.6-7.8	Low-----------	0.24			
HfB*:											
Hersh-----------	0-5	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	Low-----------	0.24	5	3	.5-1
	5-13	8-18	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.3	Low-----------	0.24			
	13-60	10-18	1.20-1.50	2.0-6.0	0.14-0.16	6.6-7.8	Low-----------	0.24			
Gates-----------	0-6	14-17	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	Low-----------	0.37	5	5	.5-1
	6-13	13-15	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
	13-60	14-17	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
HfG*:											
Hersh-----------	0-5	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	Low-----------	0.24	5	3	.5-1
	5-11	8-18	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.3	Low-----------	0.24			
	11-60	10-18	1.20-1.50	2.0-6.0	0.14-0.16	6.6-7.8	Low-----------	0.24			
Gates-----------	0-5	14-17	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	Low-----------	0.37	5	5	.5-1
	5-9	13-15	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
	9-60	14-17	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
HgF*:											
Hersh-----------	0-4	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	Low-----------	0.24	5	3	.5-1
	4-12	8-18	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.3	Low-----------	0.24			
	12-60	10-18	1.20-1.50	2.0-6.0	0.14-0.16	6.6-7.8	Low-----------	0.24			
Valentine-------	0-6	2-10	1.70-1.90	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	.5-1
	6-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	Low-----------	0.15			
Hm--------------- Hobbs	0-6	15-27	1.20-1.40	0.6-2.0	0.21-0.24	6.1-7.8	Low-----------	0.32	5	6	2-4
	6-60	15-30	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	Low-----------	0.32			
Ht--------------- Hord	0-18	17-27	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.32	5	6	2-4
	18-38	20-35	1.35-1.45	0.6-2.0	0.17-0.22	6.1-7.8	Low-----------	0.32			
	38-60	18-30	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	Low-----------	0.43			
IfB-------------- Ipage	0-5	1-5	1.40-1.50	6.0-20	0.07-0.09	5.1-7.8	Low-----------	0.15	5	1	.5-1
	5-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.1-7.8	Low-----------	0.15			
IhB-------------- Ipage	0-8	0-5	1.40-1.60	6.0-20	0.07-0.09	5.1-7.3	Low-----------	0.15	5	1	.5-1
	8-15	0-10	1.55-1.80	6.0-20	0.06-0.11	5.1-7.8	Low-----------	0.15			
	15-60	0-5	1.60-1.85	6.0-20	0.02-0.07	5.1-7.8	Low-----------	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
ImB---------------Ipage	0-6	3-10	1.35-1.55	6.0-20	0.10-0.12	5.1-7.3	Low-----------	0.17	5	2	.5-1
	6-10	0-10	1.55-1.80	6.0-20	0.06-0.11	5.1-7.8	Low-----------	0.15			
	10-60	0-5	1.60-1.85	6.0-20	0.02-0.07	5.1-7.8	Low-----------	0.15			
Lp----------------Loup	0-4	5-15	1.30-1.50	2.0-6.0	0.16-0.18	6.6-8.4	Low-----------	0.20	5	8	4-8
	4-60	2-7	1.50-1.70	6.0-20	0.06-0.08	6.6-8.4	Low-----------	0.17			
Ma----------------Marlake	0-6	3-10	1.50-1.60	6.0-20	0.10-0.14	6.6-8.4	Low-----------	0.17	2	8	4-8
	6-10	3-8	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	Low-----------	0.17			
	10-60	0-5	1.50-1.60	6.0-20	0.05-0.07	6.6-8.4	Low-----------	0.17			
Or----------------Ord	0-15	8-15	1.40-1.60	0.6-2.0	0.20-0.22	7.4-8.4	Low-----------	0.32	4	3	1-2
	15-44	8-15	1.50-1.70	2.0-6.0	0.15-0.17	6.6-8.4	Low-----------	0.20			
	44-60	3-12	1.60-1.70	2.0-20	0.02-0.04	6.6-8.4	Low-----------	0.20			
Pb*. Pits and dumps											
SmB, SmF----------Simeon	0-6	3-10	1.30-1.50	6.0-20	0.06-0.12	6.1-7.8	Low-----------	0.15	5	1	.5-1
	6-60	2-10	1.50-1.70	6.0-20	0.05-0.10	6.1-7.8	Low-----------	0.15			
To, Tp------------Tryon	0-5	3-10	1.40-1.60	6.0-20	0.10-0.12	5.6-8.4	Low-----------	0.17	5	8	4-8
	5-60	1-7	1.50-1.70	6.0-20	0.06-0.08	5.6-7.8	Low-----------	0.17			
TsB*:											
Tryon------------	0-5	3-10	1.40-1.60	6.0-20	0.10-0.12	5.6-8.4	Low-----------	0.17	5	8	4-8
	5-60	1-7	1.50-1.70	6.0-20	0.06-0.08	5.6-7.8	Low-----------	0.17			
Els--------------	0-6	3-10	1.55-1.60	6.0-20	0.08-0.13	6.1-8.4	Low-----------	0.17	5	2	1-2
	6-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-8.4	Low-----------	0.15			
TtB*:											
Tryon------------	0-4	3-10	1.40-1.60	6.0-20	0.10-0.12	5.6-8.4	Low-----------	0.17	5	8	4-8
	4-60	1-7	1.50-1.70	6.0-20	0.06-0.08	5.6-7.8	Low-----------	0.17			
Ipage------------	0-6	1-5	1.40-1.50	6.0-20	0.07-0.09	5.1-7.8	Low-----------	0.15	5	1	.5-1
	6-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.1-7.8	Low-----------	0.15			
UbD2--------------Uly	0-6	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.32	5	6	1-2
	6-21	20-30	1.20-1.30	0.6-2.0	0.18-0.22	6.1-8.4	Low-----------	0.43			
	21-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	Low-----------	0.43			
UbE---------------Uly	0-12	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.32	5	6	2-4
	12-34	20-30	1.20-1.30	0.6-2.0	0.18-0.22	6.1-8.4	Low-----------	0.43			
	34-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	Low-----------	0.43			
VaD, VaE, VaF*----Valentine	0-4	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	Low-----------	0.15	5	1	.5-1
	4-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	Low-----------	0.15			
VeB, VeD----------Valentine	0-6	2-10	1.70-1.90	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	.5-1
	6-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	Low-----------	0.15			
VmD*:											
Valentine--------	0-5	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	Low-----------	0.15	5	1	.5-1
	5-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	Low-----------	0.15			
Els--------------	0-6	3-10	1.55-1.60	6.0-20	0.08-0.13	6.1-8.4	Low-----------	0.17	5	2	1-2
	6-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-8.4	Low-----------	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
VsD*:											
Valentine-------	0-4	2-10	1.70-1.90	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	.5-1
	4-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	Low-----------	0.15			
Simeon----------	0-5	3-10	1.30-1.50	6.0-20	0.06-0.12	6.1-7.8	Low-----------	0.15	5	1	.5-1
	5-60	2-10	1.50-1.70	6.0-20	0.05-0.10	6.1-7.8	Low-----------	0.15			
Vt--------------- Vetal	0-19	10-18	1.20-1.30	2.0-6.0	0.17-0.21	5.6-7.8	Low-----------	0.28	5	5	2-4
	19-30	12-18	1.25-1.40	2.0-6.0	0.11-0.17	6.1-7.8	Low-----------	0.20			
	30-60	10-18	1.30-1.40	2.0-6.0	0.11-0.17	6.1-8.4	Low-----------	0.20			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Ab---------------- Almeria	D	Occasional	Brief-----	Apr-Jun	0-1.5	Apparent	Nov-May	Moderate	High-----	Low.
Ac---------------- Almeria	D	Occasional	Brief-----	Jan-Jul	+.5-1.0	Apparent	Nov-May	Moderate	High-----	Low.
Ad---------------- Almeria	D	Frequent----	Brief-----	Jan-Jul	+.5-1.0	Apparent	Nov-May	Moderate	High-----	Low.
Bg*: Blownout land.										
Valentine--------	A	None--------	---	---	>6.0	---	---	Low------	Low------	Low.
BhB--------------- Boelus	A	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
BkB*: Boelus-----------	A	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
Simeon-----------	A	None--------	---	---	>6.0	---	---	Low------	Low------	Low.
Bo---------------- Bolent	A	Occasional	Brief-----	Mar-Jun	1.5-3.5	Apparent	Nov-May	Moderate	Low------	Low.
Cm---------------- Calamus	A	Rare--------	---	---	3.0-6.0	Apparent	Mar-Jun	Low------	Low------	Low.
CrG*: Coly------------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
Hobbs------------	B	Occasional	Brief-----	Apr-Sep	>6.0	---	---	Moderate	Low------	Low.
Cs, CsB----------- Cozad	B	Rare--------	---	---	>6.0	---	---	Moderate	Low------	Low.
Eb---------------- Els	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
EfB*: Els--------------	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
Ipage------------	A	None--------	---	---	3.0-6.0	Apparent	Dec-Jun	Moderate	Low------	Moderate.
Em---------------- Elsmere	A	None--------	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
Fu. Fluvaquents										
GfB, GfC2, GfD, GfF-------------- Gates	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
HeB, HeC, HeD----- Hersh	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
HfB*, HfG*:										
Hersh------------	B	None---------	---	---	>6.0	---	---	Moderate	Low------	Low.
Gates------------	B	None---------	---	---	>6.0	---	---	Moderate	Low------	Low.
HgF*:										
Hersh------------	B	None---------	---	---	>6.0	---	---	Moderate	Low------	Low.
Valentine---------	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.
Hm---------------- Hobbs	B	Frequent----	Brief-----	Apr-Sep	>6.0	---	---	Moderate	Low------	Low.
Ht---------------- Hord	B	Rare---------	---	---	>6.0	---	---	Moderate	High-----	Low.
IfB--------------- Ipage	A	None---------	---	---	3.0-6.0	Apparent	Dec-Jun	Moderate	Low------	Moderate.
IhB, ImB---------- Ipage	A	None---------	---	---	3.5-6.0	Apparent	Jan-Apr	Moderate	Low------	Moderate.
Lp---------------- Loup	D	Occasional	Brief-----	Jan-Jul	0-1.5	Apparent	Nov-May	Moderate	High-----	Low.
Ma---------------- Marlake	D	None---------	---	---	+2-1.0	Apparent	Oct-Jun	Moderate	High-----	Low.
Or---------------- Ord	B	Rare---------	---	---	1.5-3.5	Apparent	Nov-May	High-----	High-----	Low.
Pb*. Pits and dumps										
SmB, SmF---------- Simeon	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.
To---------------- Tryon	D	Rare---------	---	---	0-1.5	Apparent	Nov-May	Moderate	High-----	Low.
Tp---------------- Tryon	D	Rare---------	---	---	+.5-1.0	Apparent	Nov-May	Moderate	High-----	Low.
TsB*:										
Tryon------------	D	Rare---------	---	---	0-1.5	Apparent	Nov-May	Moderate	High-----	Low.
Els--------------	A	Rare---------	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
TtB*:										
Tryon------------	D	Rare---------	---	---	0-1.5	Apparent	Nov-May	Moderate	High-----	Low.
Ipage------------	A	None---------	---	---	3.0-6.0	Apparent	Dec-Jun	Moderate	Low------	Moderate.
UbD2, UbE--------- Uly	B	None---------	---	---	>6.0	---	---	Moderate	High-----	Low.
VaD, VaE, VaF*, VeB, VeD--------- Valentine	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
VmD*:										
Valentine	A	None	---	---	>6.0	---	---	Low	Low	Low.
Els	A	Rare	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
VsD*:										
Valentine	A	None	---	---	>6.0	---	---	Low	Low	Low.
Simeon	A	None	---	---	>6.0	---	---	Low	Low	Low.
Vt Vetal	B	None	---	---	>6.0	---	---	Moderate	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

(Dashes indicate data that were not available. LL means liquid limit; PI, plasticity index; and NP, nonplastic)

Soil name*, report number, horizon, and depth in inches	Classification		Grain-size distribution									LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--					
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
												Pct		g/cc
Gates silt loam: (S84NE-115-52)														
A------ 0 to 5	A-4(8)	ML	---	---	---	---	100	87	75	---	15	30	6	2.63
C------ 15 to 60	A-4(8)	ML	---	---	---	---	100	84	68	---	10	25	3	2.68
Hord silt loam: (S84NE-115-23)														
Ap----- 0 to 7	A-4(8)	ML	---	---	---	---	100	92	69	---	13	26	2	2.59
Bw----- 17 to 26	A-6(8)	CL	---	---	---	---	100	99	80	---	22	34	11	2.62
C------ 38 to 60	A-4(8)	ML	---	---	---	---	100	92	68	---	15	29	5	2.62
Ipage fine sand, terrace: (S84NE-115-65)														
A------ 0 to 8	A-2-4(2)	SM	---	---	---	100	96	13	5	---	0	NP	NP	2.60
C2 & C3 22 to 46	A-3(2)	SP	---	---	100	99	86	2	1	---	0	1	NP	2.69
C4----- 46 to 60	A-3(2)	SP-SM	---	---	100	99	92	9	3	---	1	NP	NP	2.62
Ord very fine sandy loam: (S84NE-115-56)														
Ap----- 0 to 5	A-4(6)	ML	---	---	---	---	100	65	36	---	11	27	2	2.61
C2----- 20 to 44	A-4(6)	ML	---	---	---	100	99	66	32	---	9	23	1	2.59
C3----- 44 to 60	A-2-4(2)	SP-SM	---	---	---	100	98	12	4	---	1	NP	NP	2.60
Simeon sand: (S84NE-115-55)														
A------ 0 to 6	A-3(2)	SP-SM	---	---	---	100	92	7	4	---	1	NP	NP	2.63
C2----- 18 to 28	A-3(2)	SP	---	---	---	100	95	2	2	---	0	NP	NP	2.63
C3----- 28 to 60	A-3(2)	SP	100	99	98	97	84	1	0	---	0	NP	NP	2.61

See footnote at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name*, report number, horizon, and depth in inches	Classification		Grain-size distribution									LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--					
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
												Pct		g/cc
Valentine fine sand: (S84NE-115-43)														
A------ 0 to 4	A-2-4(0)	SM	---	---	---	100	97	24	15	---	2	NP	NP	2.62
C------ 4 to 60	A-2-4(2)	SM	---	---	---	100	98	14	6	---	2	NP	NP	2.65

* Locations of the sampled pedons are as follows:

Gates silt loam: 2,250 feet south and 2,100 feet east of the northwest corner of sec. 30, T. 21 N., R. 19 W.

Hord silt loam: 2,450 feet north and 2,400 feet east of the southwest corner of sec. 34, T. 21 N., R. 17 W.

Ipage fine sand: terrace, 2,200 feet north and 2,100 feet east of the southwest corner of sec. 16, T. 21 N., R. 18 W.

Ord very fine sandy loam: 2,350 feet west and 400 feet north of the southeast corner of sec. 18, T. 21 N., R. 18 W.

Simeon sand: 2,500 feet east and 800 feet south of the northwest corner of sec. 33, T. 22 N., R. 19 W.

Valentine fine sand: 2,600 feet east and 125 feet north of the southwest corner of sec. 26, T. 22 N., R. 18 W.

TABLE 20.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Almeria	Sandy, mixed, mesic Typic Fluvaquents
*Boelus	Sandy over loamy, mixed, mesic Udic Haplustolls
Bolent	Sandy, mixed, mesic Aquic Ustifluvents
Calamus	Mixed, mesic Aquic Ustipsamments
Coly	Fine-silty, mixed (calcareous), mesic Typic Ustorthents
Cozad	Coarse-silty, mixed, mesic Fluventic Haplustolls
Els	Mixed, mesic Aquic Ustipsamments
Elsmere	Sandy, mixed, mesic Aquic Haplustolls
Fluvaquents	Sandy, mixed, mesic Fluvaquents
Gates	Coarse-silty, mixed, nonacid, mesic Typic Ustorthents
Hersh	Coarse-loamy, mixed, nonacid, mesic Typic Ustorthents
Hobbs	Fine-silty, mixed, nonacid, mesic Mollic Ustifluvents
Hord	Fine-silty, mixed, mesic Cumulic Haplustolls
Ipage	Mixed, mesic Aquic Ustipsamments
Loup	Sandy, mixed, mesic Typic Haplaquolls
Marlake	Sandy, mixed, mesic Mollic Fluvaquents
*Ord	Coarse-loamy over sandy or sandy-skeletal, mesic Aeric Calciaquolls
Simeon	Mixed, mesic Typic Ustipsamments
Tryon	Mixed, mesic Typic Psammaquents
Uly	Fine-silty, mixed, mesic Typic Haplustolls
Valentine	Mixed, mesic Typic Ustipsamments
Vetal	Coarse-loamy, mixed, mesic Pachic Haplustolls

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Soil name and map symbol	Land capability* N	Land capability* I	Prime farmland*	Range site	Windbreak group
Ab------------------------- Almeria	Vw-7	---	---	Wet Subirrigated-----	2D
Ac------------------------- Almeria	Vw-7	---	---	Wetland--------------	10
Ad------------------------- Almeria	VIw-7	---	---	---	10
Bg-------------------------	VIIe-5	---	---		
Blownout land--------------				---	10
Valentine------------------				Sands----------------	10
BhB------------------------ Boelus	IIIe-5	IIIe-11	---	Sandy----------------	5
BkB------------------------	VIe-5	IVe-11	---		
Boelus---------------------				Sandy----------------	5
Simeon---------------------				Shallow to Gravel----	10
Bo------------------------- Bolent	IVw-5	IVw-11	---	Subirrigated---------	2S
Cm------------------------- Calamus	VIe-5	IVe-14	---	Sandy----------------	7
CrG------------------------	VIIe-9	---	---		
Coly-----------------------				Thin Loess-----------	10
Hobbs----------------------				Silty Overflow-------	1
Cs------------------------- Cozad	IIc-1	I-6	Yes	Silty Lowland--------	1
CsB------------------------ Cozad	IIe-1	IIe-6	Yes	Silty Lowland--------	1
Eb------------------------- Els	IVw-5	IVw-11	---	Subirrigated---------	2S
EfB------------------------	VIe-5	IVe-12	---		
Els------------------------				Subirrigated---------	2S
Ipage----------------------				Sandy Lowland--------	7
Em------------------------- Elsmere	IVw-5	IVw-11	---	Subirrigated---------	2S
Fu------------------------- Fluvaquents	VIIIw-7	---	---	---	10
GfB------------------------ Gates	IIe-9	IIe-6	Yes	Silty----------------	3
GfC2----------------------- Gates	IIIe-9	IIIe-6	Yes	Silty----------------	3
GfD------------------------ Gates	IVe-9	IVe-6	---	Silty----------------	3

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability* N	Land capability* I	Prime farmland*	Range site	Windbreak group
GfF: Gates	VIe-9	---	---	Silty	10
HeB: Hersh	IIIe-3	IIe-8	Yes	Sandy	5
HeC: Hersh	IIIe-3	IIIe-8	Yes	Sandy	5
HeD: Hersh	IVe-3	IVe-8	---	Sandy	5
HfB:	IIIe-3	IIe-8	Yes		
Hersh				Sandy	5
Gates				Silty	3
HfG:	VIIe-3	---	---		
Hersh				Sandy	10
Gates				Silty	10
HgF:	VIe-3	---	---		
Hersh				Sandy	10
Valentine				Sands	10
Hm: Hobbs	VIw-7	---	---	Silty Overflow	10
Ht: Hord	IIc-1	I-6	Yes	Silty Lowland	1
IfB: Ipage	VIe-5	IVe-12	---	Sandy Lowland	7
IhB: Ipage	VIe-5	IVe-12	---	Sandy	7
ImB: Ipage	IVe-5	IVe-11	---	Sandy	5
Lp: Loup	Vw-7	---	---	Wet Subirrigated	2D
Ma: Marlake	VIIIw-7	---	---	---	10
Or: Ord	IIw-4	IIw-8	Yes	Subirrigated	2S
Pb: Pits and dumps	VIIIs-8	---	---	---	10
SmB: Simeon	VIs-4	IVs-14	---	Shallow to Gravel	10
SmF: Simeon	VIs-4	---	---	Shallow to Gravel	10
To: Tryon	Vw-7	---	---	Wet Subirrigated	2D
Tp: Tryon	Vw-7	---	---	Wetland	10

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability* N	Land capability* I	Prime farmland*	Range site	Windbreak group
TsB	Vw-7	---	---		
Tryon				Wet Subirrigated	2D
Els				Subirrigated	2S
TtB	Vw-7	---	---		
Tryon				Wet Subirrigated	2D
Ipage				Sandy Lowland	7
UbD2 Uly	IVe-8	IVe-6	---	Silty	3
UbE Uly	VIe-1	---	---	Silty	3
VaD Valentine	VIe-5	IVe-12	---	Sands	7
VaE Valentine	VIe-5	---	---	Sands	7
VaF	VIIe-5	---	---		
Rolling				Sands	10
Hilly				Choppy Sands	10
VeB Valentine	IVe-5	IVe-11	---	Sandy	5
VeD Valentine	VIe-5	IVe-11	---	Sands	7
VmD	VIe-5	IVe-12	---		
Valentine				Sands	7
Els				Subirrigated	2S
VsD	VIe-5	IVe-12	---		
Valentine				Sands	7
Simeon				Shallow to Gravel	10
Vt Vetal	IIc-1	I-6	Yes	Silty	5

* A soil complex is treated as a single management unit in the land capability and prime farmland columns. The N column is for nonirrigated soils; the I column is for irrigated soils.

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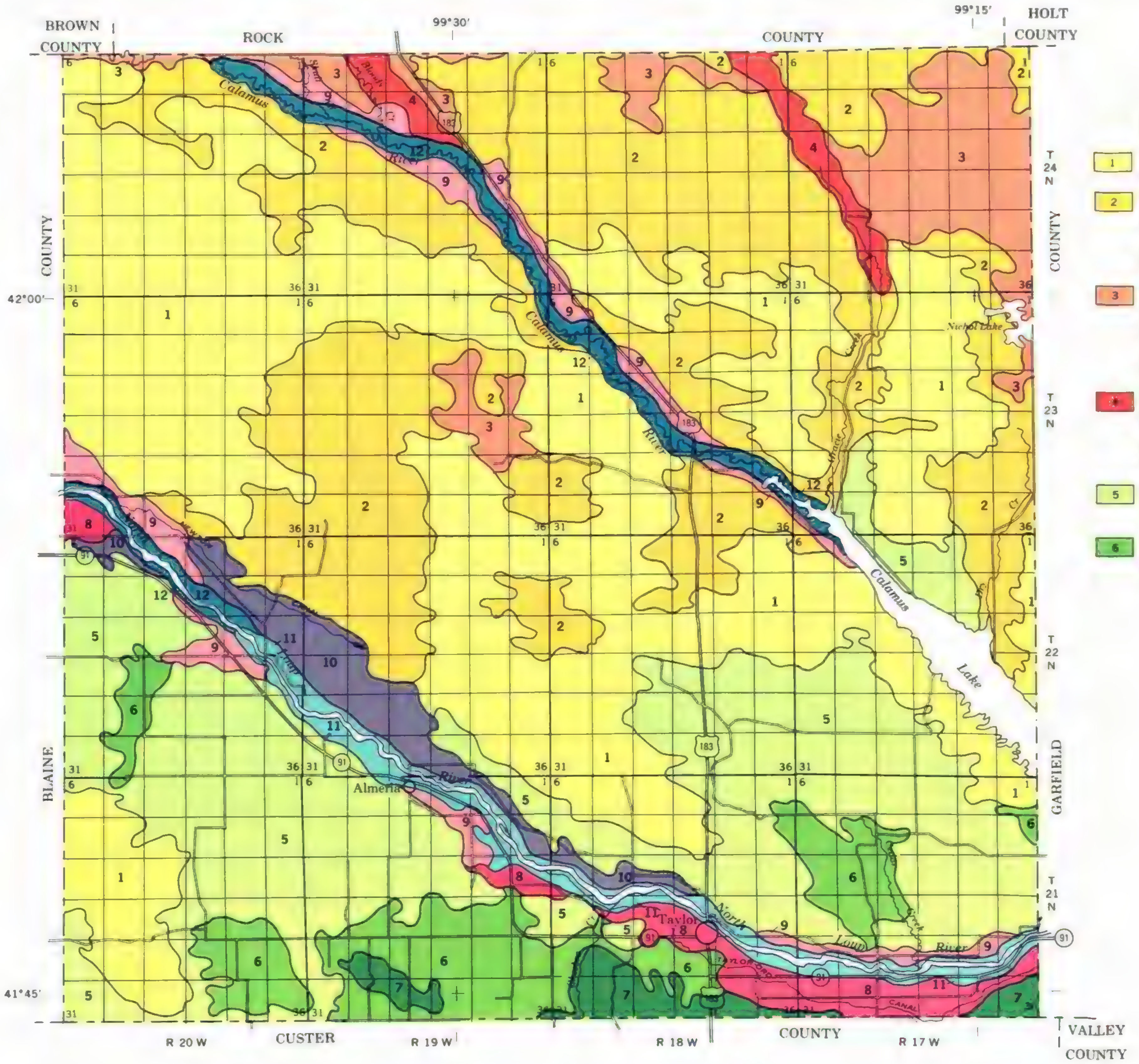


SOIL LEGEND*

EXCESSIVELY DRAINED AND MODERATELY WELL DRAINED SOILS IN THE SANDHILLS

1 Valentine association: Deep, rolling and hilly, excessively drained, sandy soils; on uplands

2 Valentine-Ipage association: Deep, nearly level to hilly, excessively drained and moderately well drained, sandy soils; on uplands and in sandhill valleys

EXCESSIVELY DRAINED, POORLY DRAINED, VERY POORLY DRAINED, AND MODERATELY WELL DRAINED SOILS IN THE SANDHILLS

3 Valentine-Tryon-Ipage association: Deep, nearly level to hilly, excessively drained, poorly drained, very poorly drained, and moderately well drained, sandy soils; on uplands and in sandhill valleys

MODERATELY WELL DRAINED TO VERY POORLY DRAINED SOILS IN THE SANDHILLS

4 Els-Tryon-Ipage association: Deep, nearly level and very gently sloping, moderately well drained to very poorly drained, sandy soils; in sandhill valleys

EXCESSIVELY DRAINED TO WELL DRAINED, SANDY, LOAMY, AND SILTY SOILS ON UPLANDS

5 Valentine-Hersh-Gates association: Deep, nearly level to rolling, excessively drained and well drained, sandy, loamy, and silty soils; on uplands

6 Hersh-Gates-Valentine association: Deep, nearly level to very steep, excessively drained to well drained, loamy, silty, and sandy soils; on uplands

EXCESSIVELY DRAINED AND WELL DRAINED, SILTY SOILS ON DISSECTED UPLANDS AND BOTTOM LAND

7 Coly-Uly-Hobbs association: Deep, very gently sloping to very steep, excessively drained and well drained, silty soils; on uplands and bottom land

EXCESSIVELY DRAINED, WELL DRAINED, MODERATELY WELL DRAINED, AND SOMEWHAT POORLY DRAINED, SILTY AND SANDY SOILS ON STREAM TERRACES AND UPLANDS

8 Cozad-Hord association: Deep, nearly level and very gently sloping, well drained, silty soils; on stream terraces

9 Ipage-Valentine-Elsmere association: Deep, nearly level to strongly sloping, excessively drained, moderately well drained, and somewhat poorly drained, sandy soils; on stream terraces and uplands

10 Valentine-Simeon-Boelus association: Deep, nearly level to strongly sloping, excessively drained and well drained, sandy soils; on uplands and stream terraces

MODERATELY WELL DRAINED TO VERY POORLY DRAINED, LOAMY AND SANDY SOILS ON BOTTOM LAND

11 Ord-Bolent-Almeria association: Deep, nearly level, somewhat poorly drained to very poorly drained, loamy and sandy soils; on bottom land

12 Almeria-Calamus-Bolent association: Deep, nearly level, moderately well drained to very poorly drained, sandy soils; on bottom land

*Texture terms in the descriptive headings refer to the surface layer of the major soils in the associations.

Compiled 1988

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF NEBRASKA CONSERVATION AND SURVEY DIVISION

GENERAL SOIL MAP

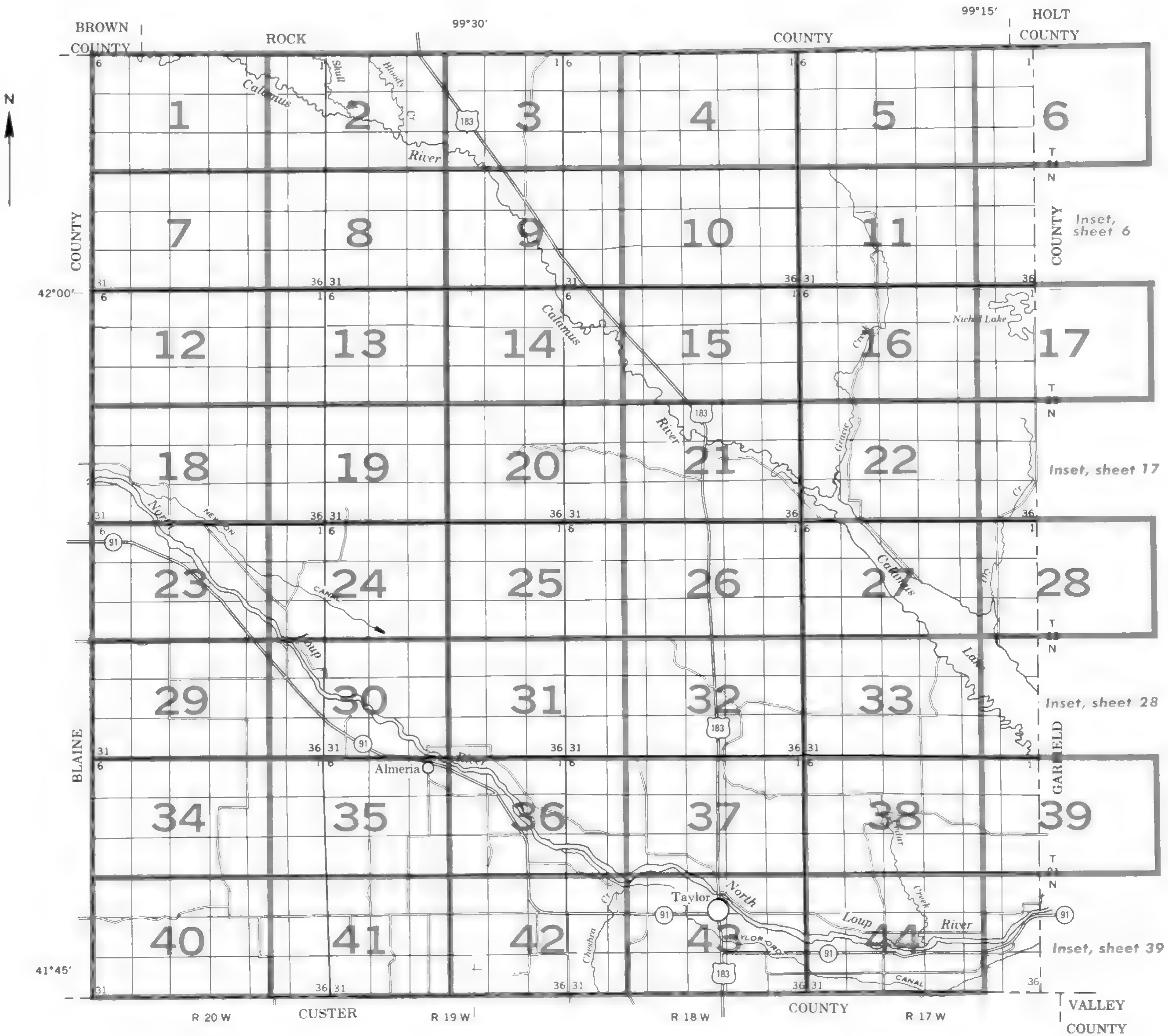
LOUP COUNTY, NEBRASKA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

LOUP COUNTY, NEBRASKA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

Original text from each individual map sheet read:
This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is moderately eroded and 3 that it is severely eroded.

SYMBOL	NAME
Ab	Almeria loamy fine sand, 0 to 2 percent slopes
Ac	Almeria loamy fine sand, wet, 0 to 2 percent slopes
Ad	Almeria fine sandy loam, channeled
Bg	Blowout land-Valentine complex, 6 to 60 percent slopes
BhB	Boelus loamy fine sand, sandy substratum, 0 to 3 percent slopes
BkB	Boelus sandy substratum-Simeon loamy sands, 0 to 3 percent slopes
Bo	Bolent loamy fine sand, 0 to 2 percent slopes
Cm	Calamus loamy fine sand, 0 to 2 percent slopes
CrG	Coly-Hobbs silt loams, 2 to 60 percent slopes
Cs	Cozad silt loam, 0 to 1 percent slopes
CsB	Cozad silt loam, 1 to 3 percent slopes
Eb	Els loamy sand, 0 to 2 percent slopes
EfB	Els-Ipage fine sands, 0 to 3 percent slopes
Em	Elsmere loamy fine sand, 0 to 2 percent slopes
Fu	Fluvaquents, sandy
GfB	Gates silt loam, 1 to 3 percent slopes
GfC2	Gates silt loam, 3 to 6 percent slopes, eroded
GfD	Gates silt loam, 6 to 11 percent slopes
GfF	Gates silt loam, 11 to 30 percent slopes
HeB	Hersh fine sandy loam, 0 to 3 percent slopes
HeC	Hersh fine sandy loam, 3 to 6 percent slopes
HeD	Hersh fine sandy loam, 6 to 11 percent slopes
HfB	Hersh-Gates complex, 0 to 3 percent slopes
HfG	Hersh-Gates complex, 20 to 60 percent slopes
HgF	Hersh-Valentine complex, 9 to 24 percent slopes
Hm	Hobbs silt loam, channeled
Ht	Hord silt loam, 0 to 1 percent slopes
IfB	Ipage fine sand, 0 to 3 percent slopes
IhB	Ipage fine sand, terrace, 0 to 3 percent slopes
ImB	Ipage loamy fine sand, terrace, 0 to 3 percent slopes
Lp	Loup fine sandy loam, 0 to 2 percent slopes
Ma	Marlake loamy fine sand, 0 to 2 percent slopes
Or	Ord very fine sandy loam, 0 to 2 percent slopes
Pb	Pits and dumps
SmB	Simeon sand, 0 to 3 percent slopes
SmF	Simeon sand, 3 to 30 percent slopes
To	Tryon loamy fine sand, 0 to 2 percent slopes
Tp	Tryon loamy fine sand, wet, 0 to 2 percent slopes
TsB	Tryon-Els loamy fine sands, 0 to 2 percent slopes
TtB	Tryon-Ipage complex, 0 to 3 percent slopes
UbD2	Uly silt loam, 6 to 11 percent slopes, eroded
UbE	Uly silt loam, 11 to 17 percent slopes
VaD	Valentine fine sand, 3 to 9 percent slopes
VaE	Valentine fine sand, rolling
VaF	Valentine fine sand, rolling and hilly
VeB	Valentine loamy fine sand, 0 to 3 percent slopes
VeD	Valentine loamy fine sand, 3 to 9 percent slopes
VmD	Valentine-Els complex, 0 to 9 percent slopes
VsD	Valentine-Simeon complex, 0 to 9 percent slopes
Vt	Vetal loam, 0 to 1 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- cemetery — Davis Airstrip

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Federal
- State

DAMS

- Large (to scale)
- Medium or small — water

PITS

- Gravel pit (up to 5 acres)

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Located object (label) — Tower

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
- Drainage and/or irrigation

CALAMUS RESERVOIR

- Approximate permanent pool boundary (approximate elevation 2244 feet)
- Approximate flood pool boundary (approximate elevation 2252.8 feet) — FLOOD POOL LINE

LAKES, PONDS AND RESERVOIRS

- Perennial — water
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh (up to 3 acres)
- Well, irrigation
- Wet spot (up to 3 acres)

SPECIAL SYMBOLS FOR SOIL SURVEY

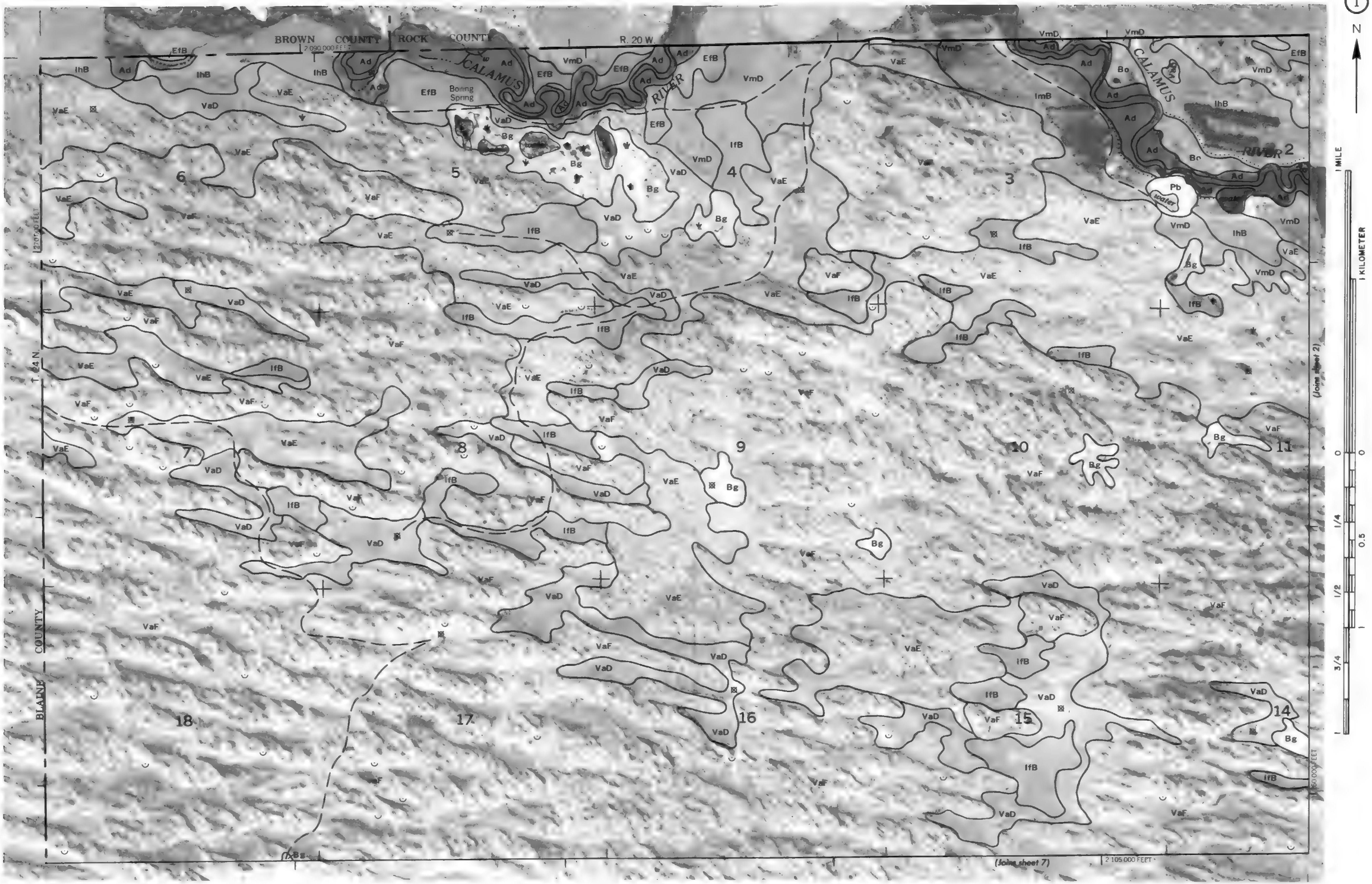
SOIL DELINEATIONS AND SYMBOLS — VaF IfB

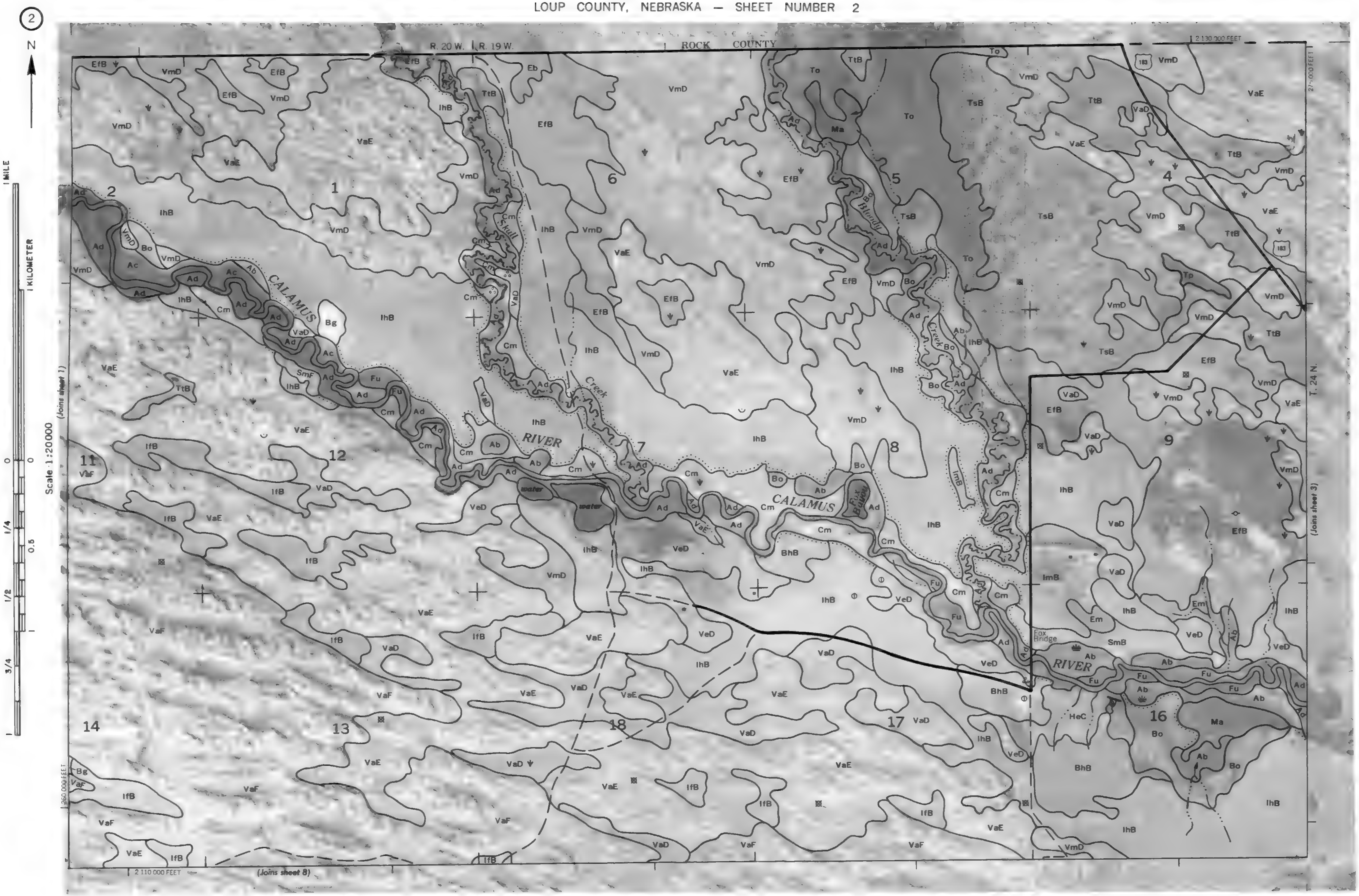
SHORT STEEP SLOPE

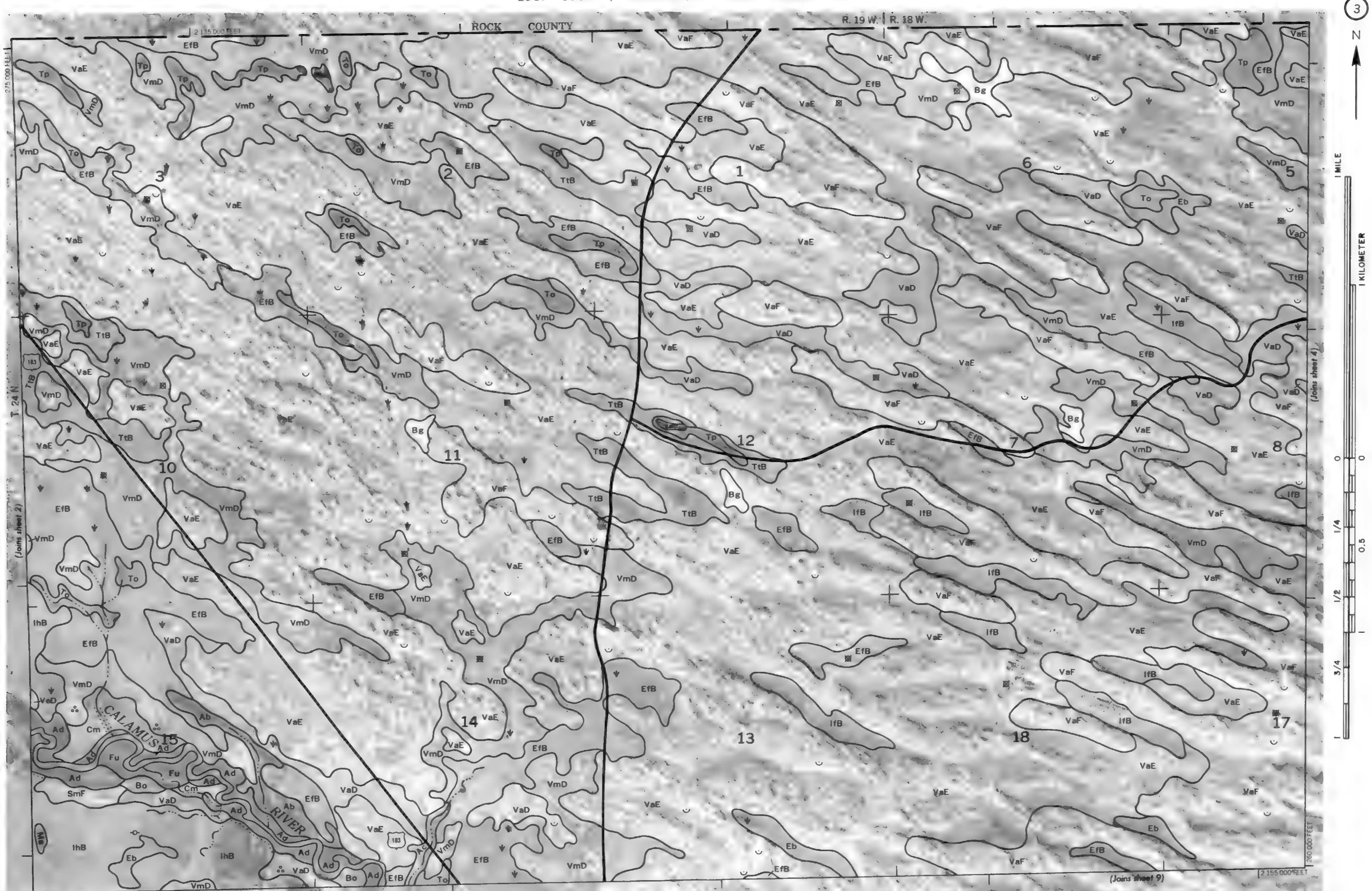
DEPRESSION (up to 5 acres)

MISCELLANEOUS

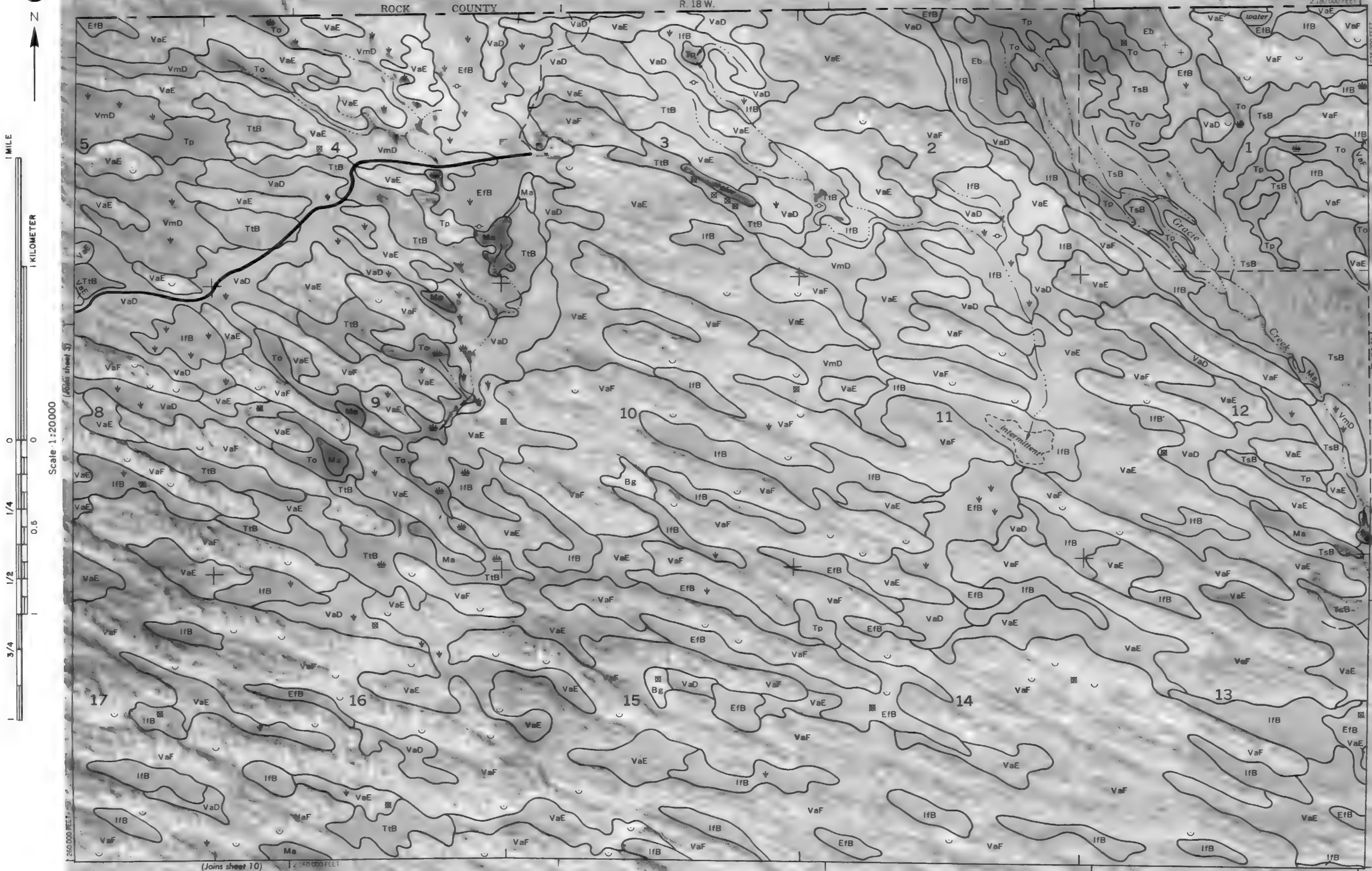
- Blowout (up to 5 acres)
- Gravelly spot (up to 3 acres)
- Saline spot (up to 3 acres)
- Sandy spot (up to 5 acres)
- Severely eroded spot (up to 5 acres)
- Livestock watering facility
- Loess outcrop in sand (up to 3 acres)
- Reddish brown loess spot (up to 3 acres)
- Siphon


1
N
BROWN COUNTY
ROCK COUNTY
BLAINE COUNTY
R. 20 W.
T. 24 N.
CALAMUS RIVER
Boiling Spring
water
2 090 000 FEET
2 105 000 FEET
(Joins sheet 2)
(Joins sheet 7)
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18
Ad
Bg
Bo
EfB
IfB
IhB
ImB
Pb
VaD
VaE
VaF
VmD

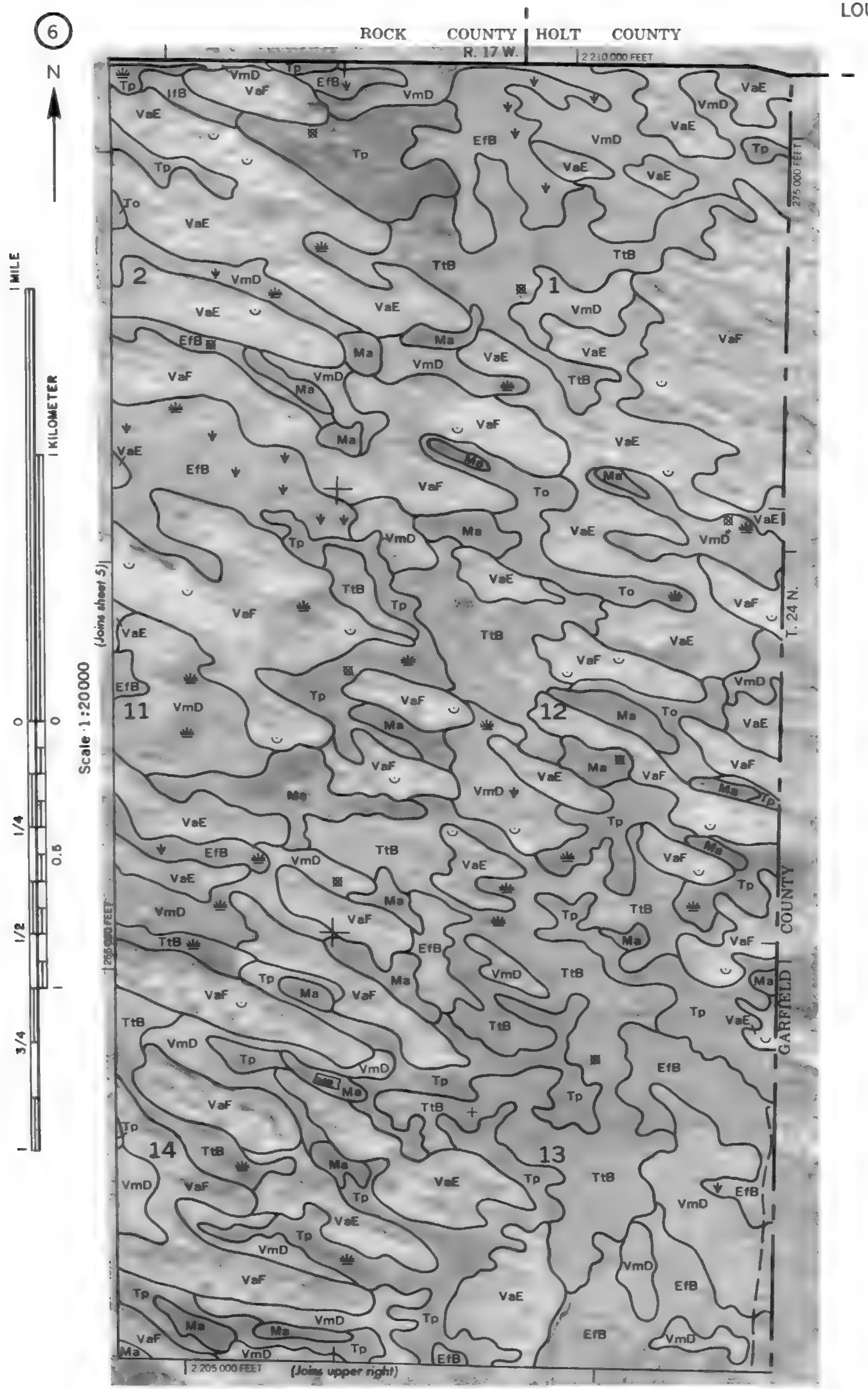

2
N
1 MILE
1 KILOMETER
Scale 1:20000
R. 20 W.
R. 19 W.
ROCK COUNTY
2 130 000 FEET
T. 24 N.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 8)
2 110 000 FEET
CALAMUS RIVER
CALAMUS
RIVER
Skull Creek
Blondy Creek
Fox Bayou
Fox Bridge
water

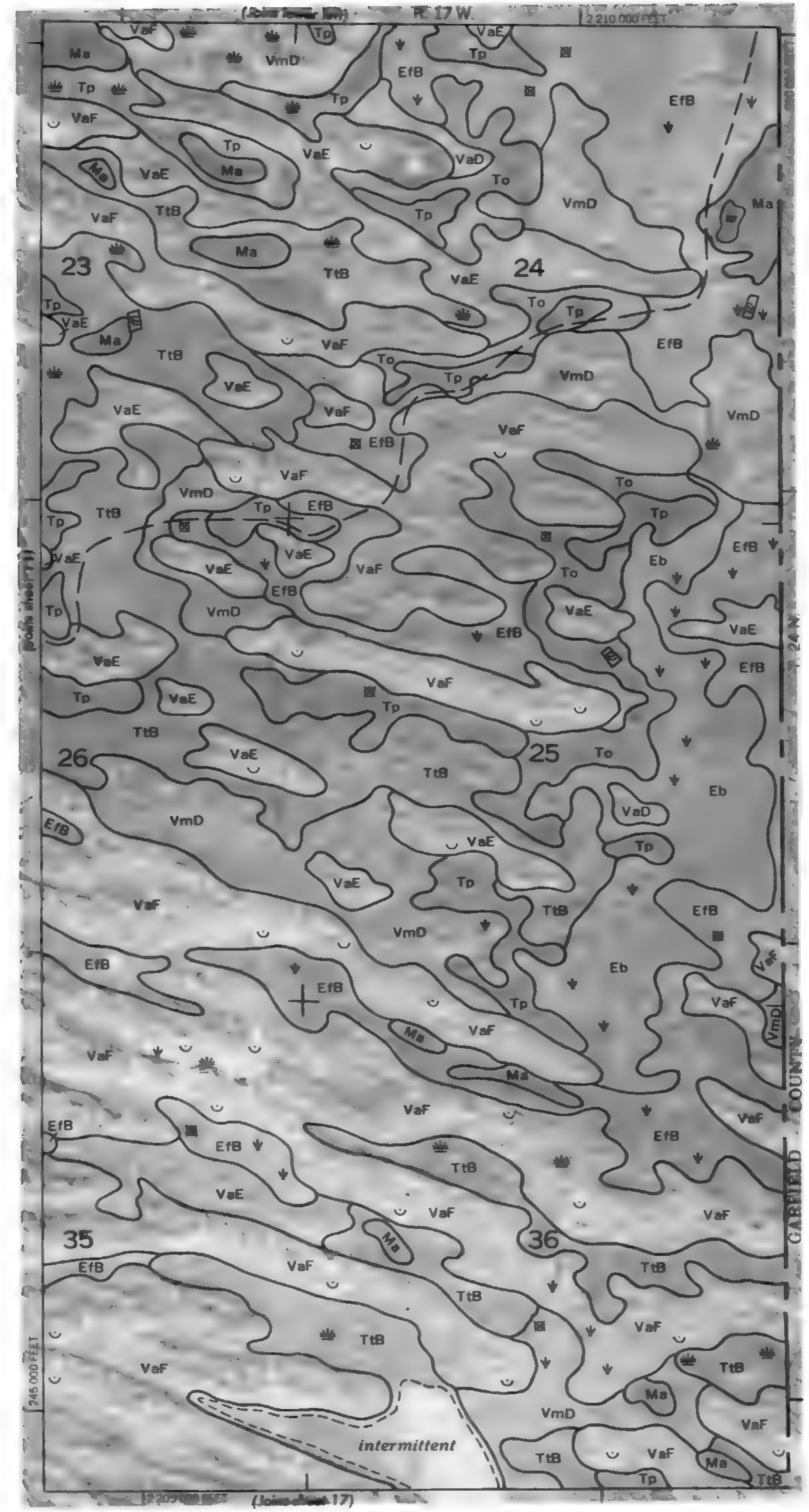

3
N
ROCK COUNTY
R. 19 W. | R. 18 W.
T. 24 N.
CALAMUS RIVER
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 9)
2 135 000 FEET
2 155 000 FEET
275 000 FEET
250 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
183

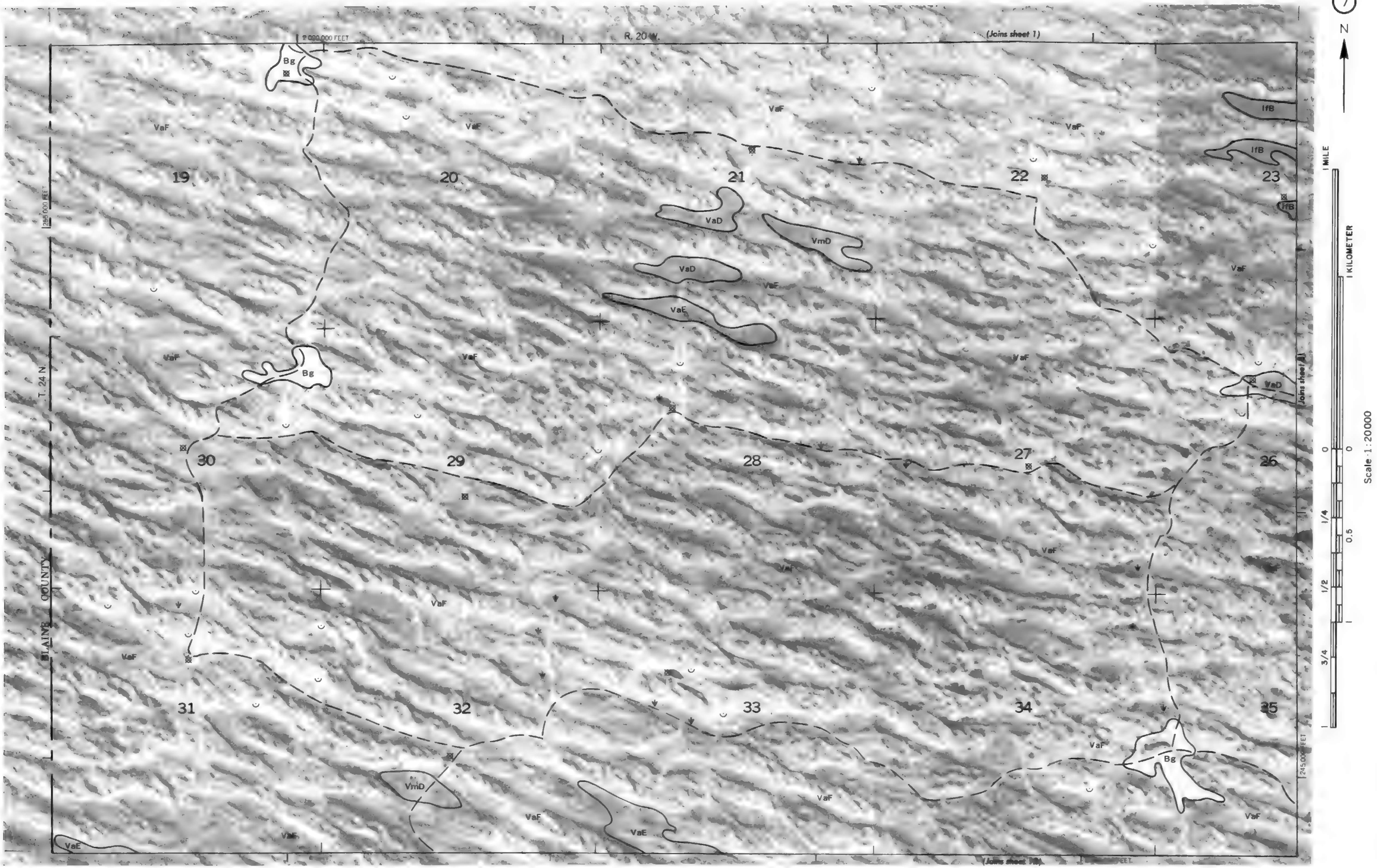
4

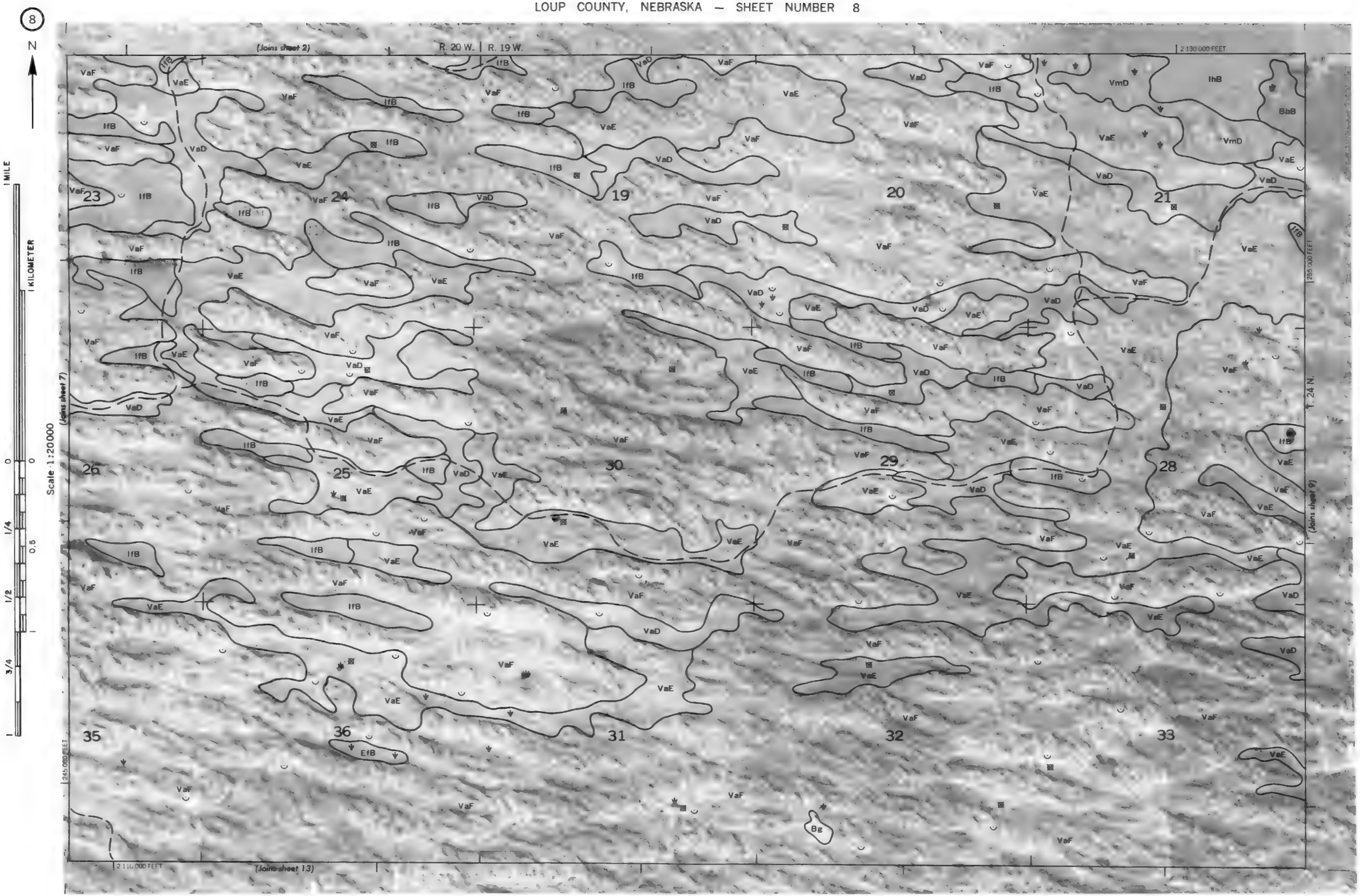

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
0.5
1/2
3/4
1
ROCK COUNTY
R. 18 W.
2 180 000 FEET
275 000 FEET
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 10)
2 160 000 FEET
260 000 FEET
T. 24 N.
Gracie
Creek
Intermittent
water
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
VaE
VaF
VaD
VmD
IfB
EfB
TtB
TsB
To
Tp
Ma
Eb
Bg

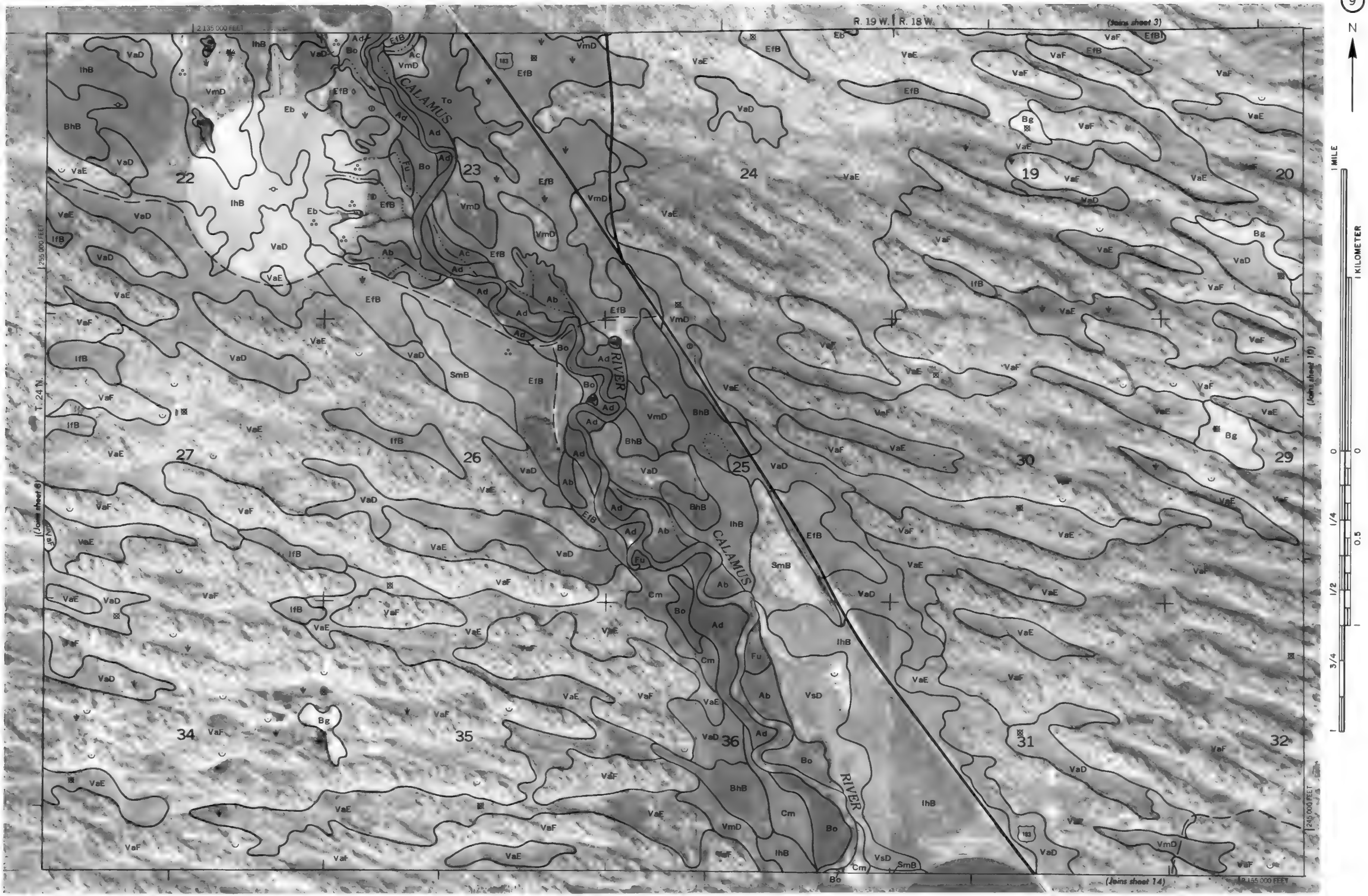

5
N
ROCK COUNTY
R. 17 W.
2 185 000 FEET
275 000 FEET
T. 24 N.
(Joins sheet 6)
(Joins sheet 4)
(Joins sheet 11)
2 200 000 FEET
265 000 FEET
Gracie
Creek
1 MILE
1 KILOMETER
Scale 1:20000

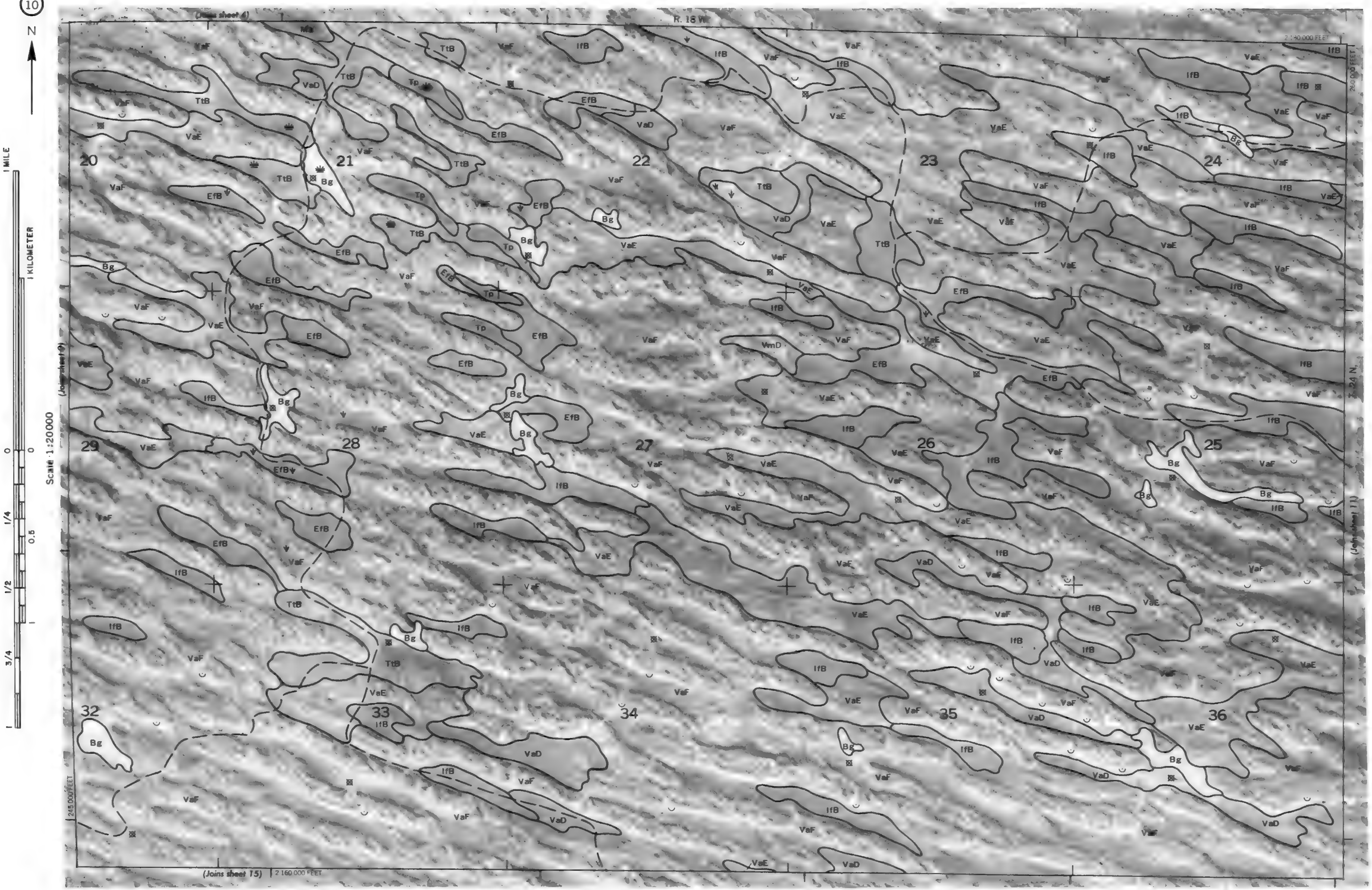

6
N
ROCK COUNTY
HOLT COUNTY
R. 17 W.
2 210 000 FEET
275 000 FEET
T. 24 N.
GARFIELD COUNTY
(Joins sheet 5)
265 000 FEET
2 205 000 FEET
(Joins upper right)
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
2
1
11
12
14
13

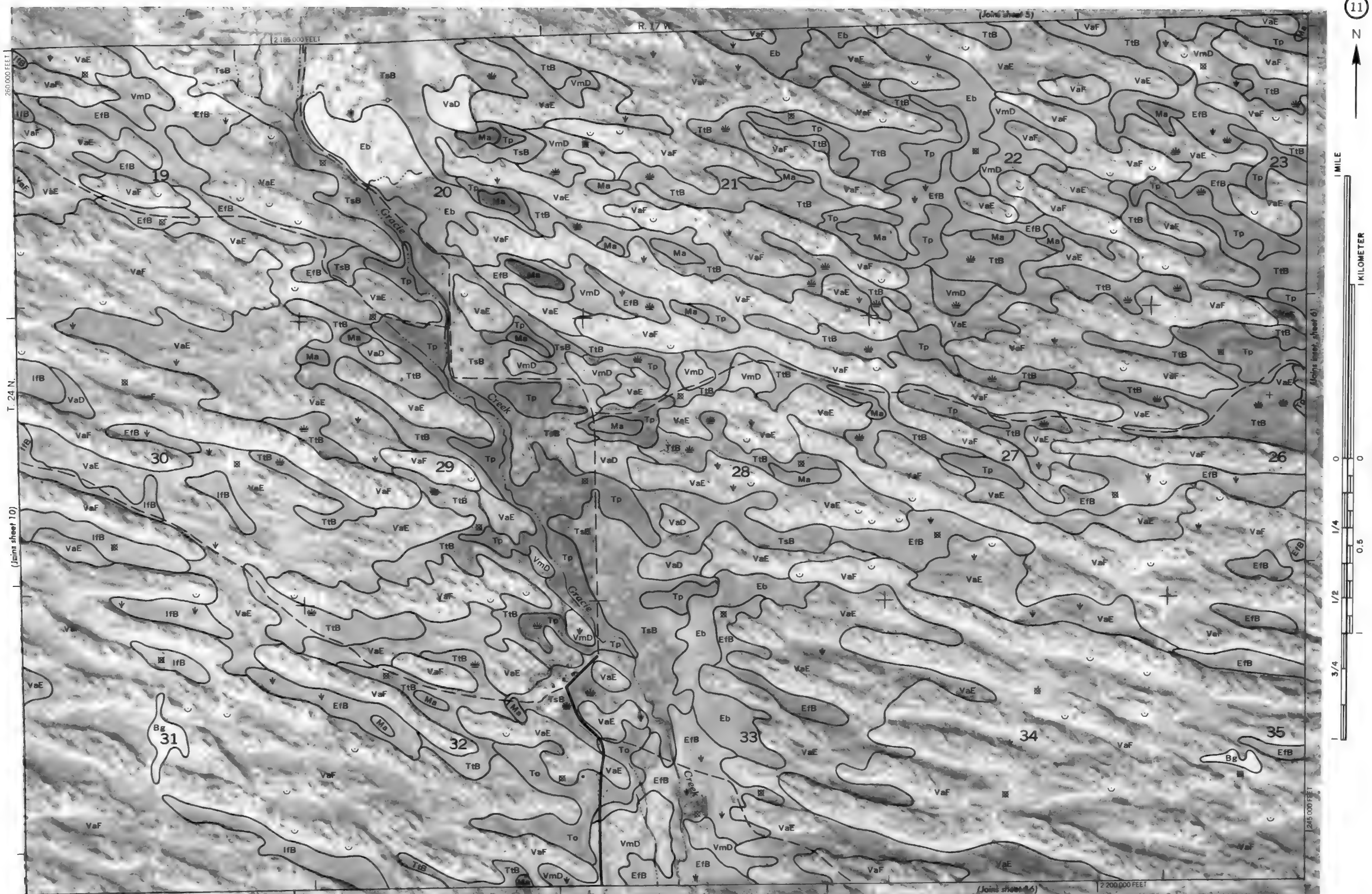

(Joins lower left)
R. 17 W.
2 210 000 FEET
(Joins sheet 11)
T. 24 N.
GARFIELD COUNTY
245 000 FEET
2 205 000 FEET
(Joins sheet 17)
intermittent
23
24
26
25
35
36

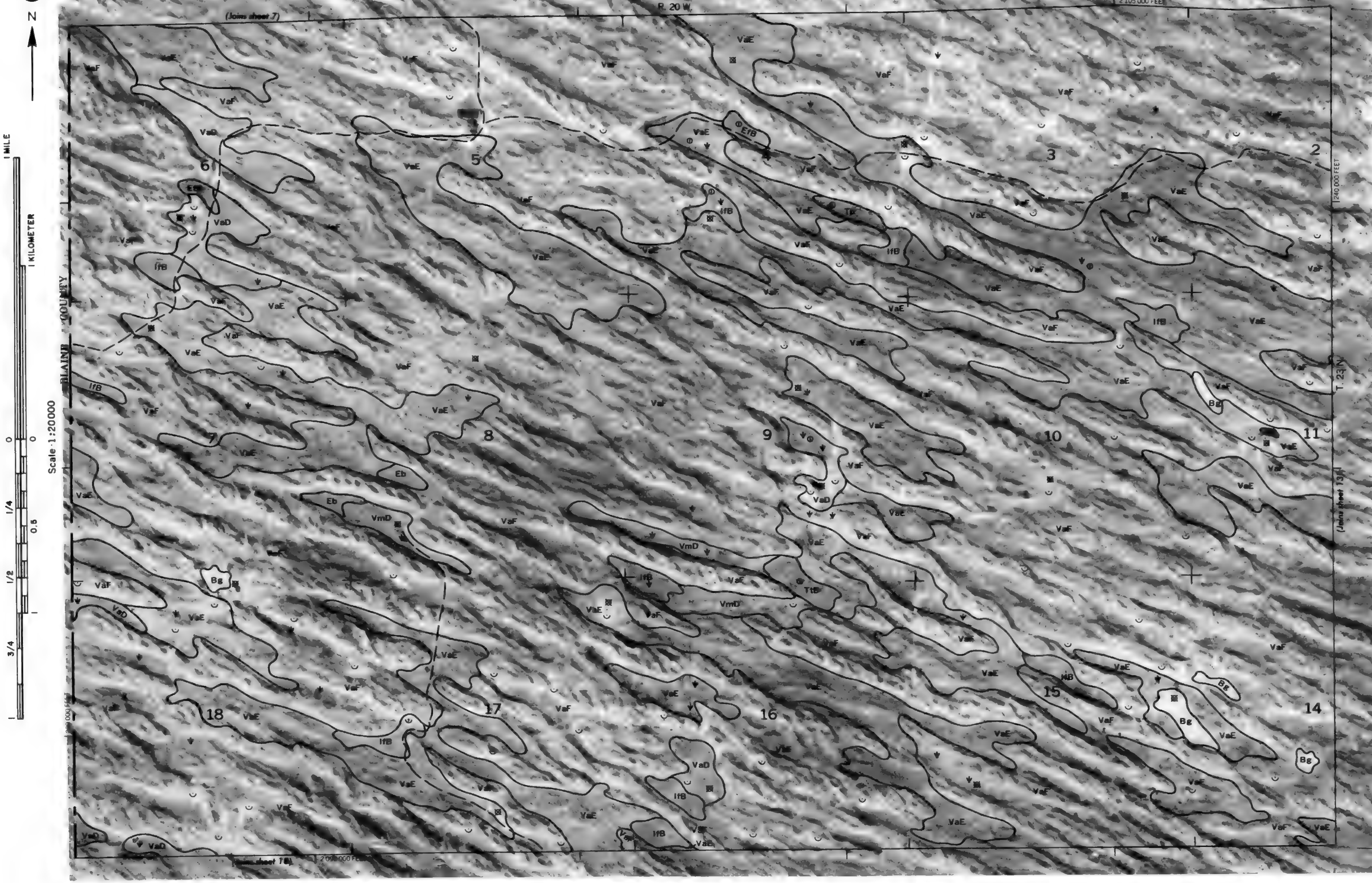

7
N
R. 20 W.
(Joins sheet 1)
2 000 000 FEET
T. 24 N.
BLAINE COUNTY
Bg
VaF
VaD
VmD
VaE
IfB
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
(Joins sheet 8)
(Joins sheet 10)


8
N
(Joins sheet 2)
R. 20 W.
R. 19 W.
2 130 000 FEET
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 13)
2 110 000 FEET
245 000 FEET
265 000 FEET
T. 24 N.
Scale 1:20000
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0
0.5
1
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
VaF
VaE
VaD
IfB
VmD
IhB
BbB
EfB
Bg

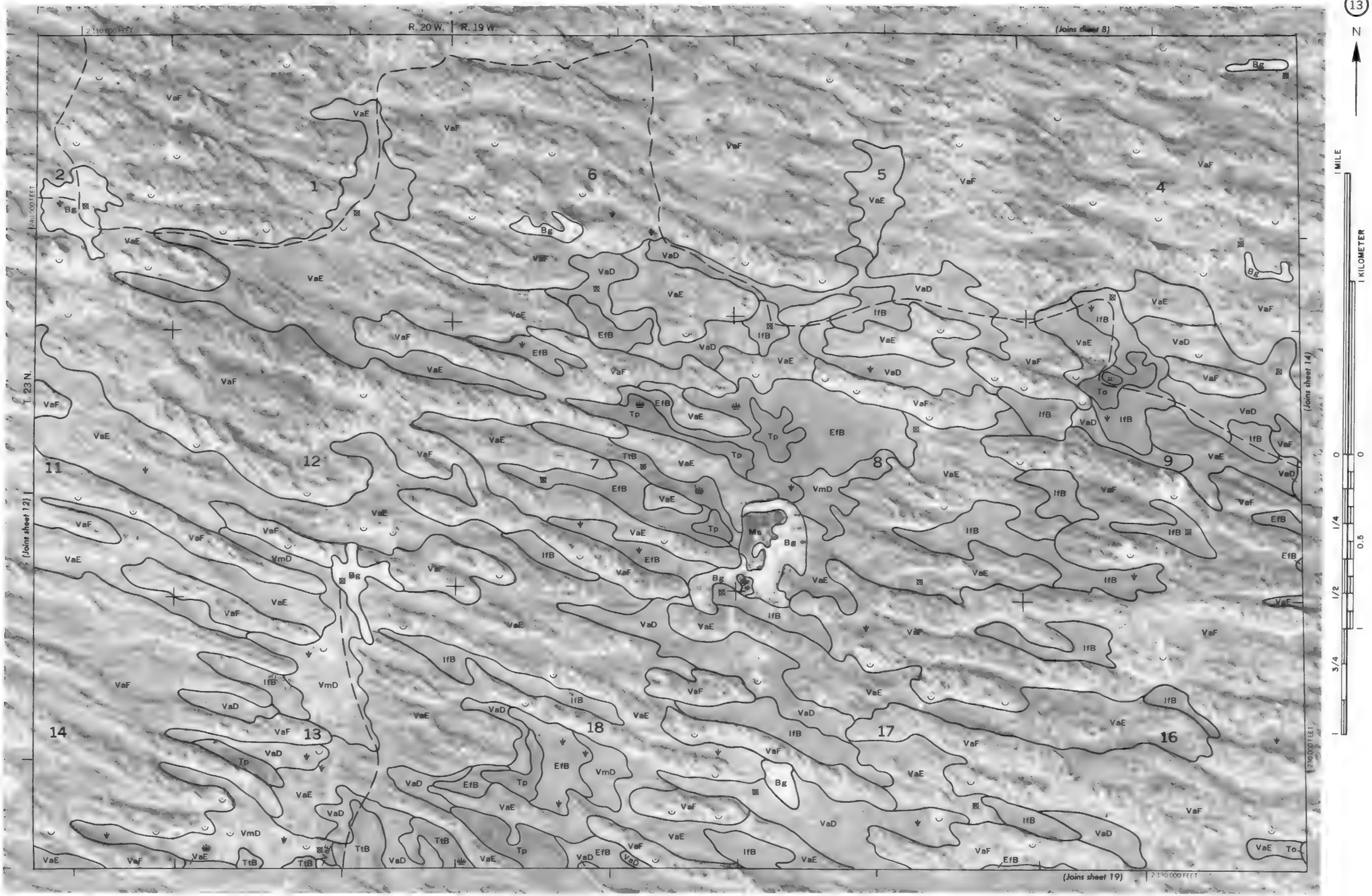

9
N
R. 19 W. | R. 18 W.
(Joins sheet 3)
(Joins sheet 14)
(Joins sheet 8)
(Joins sheet 10)
T. 24 N.
2 135 000 FEET
2 155 000 FEET
255 000 FEET
245 000 FEET
CALAMUS
RIVER
CALAMUS
RIVER
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
183
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0
0.5
Scale 1:20000
VaD
VaE
VaF
VmD
IhB
BhB
Eb
EfB
IfB
Ad
Ab
Ac
Bo
Fu
To
SmB
Bg
Cm
VsD


10
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 4)
R. 18 W.
(Joins sheet 15)
2 160 000 FEET
(Joins sheet 11)
(Joins sheet 9)
T. 24 N.
245 000 FEET
260 000 FEET
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36
VaF
VaE
VaD
TtB
Tp
EfB
IfB
Bg
WnD

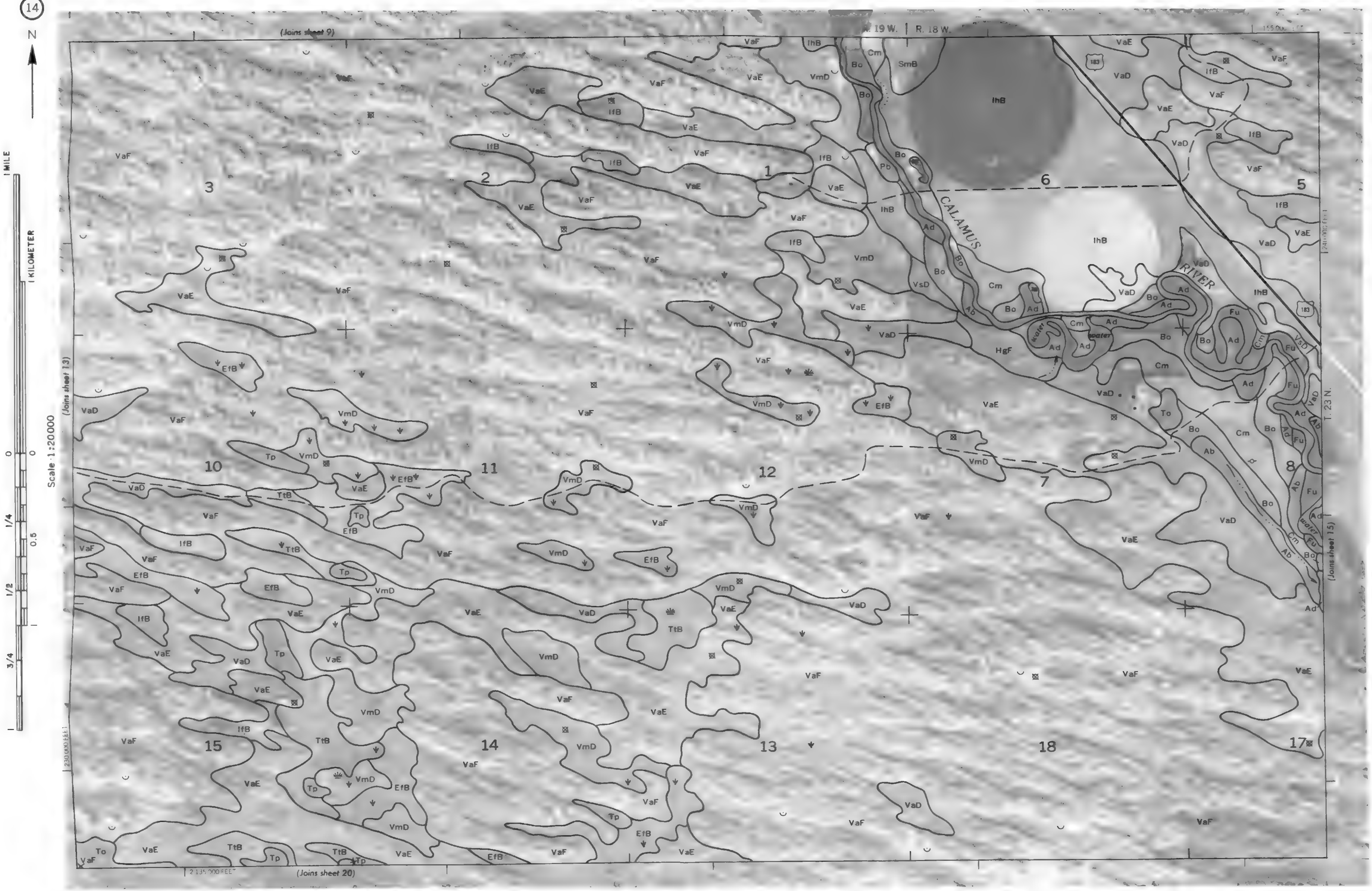

11
N
(Joins sheet 5)
R. 17 W.
2 185 000 FEET
260 000 FEET
T. 24 N.
(Joins sheet 10)
(Joins inset, sheet 6)
(Joins sheet 16)
2 200 000 FEET
245 000 FEET
Gracie Creek
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0
0.5

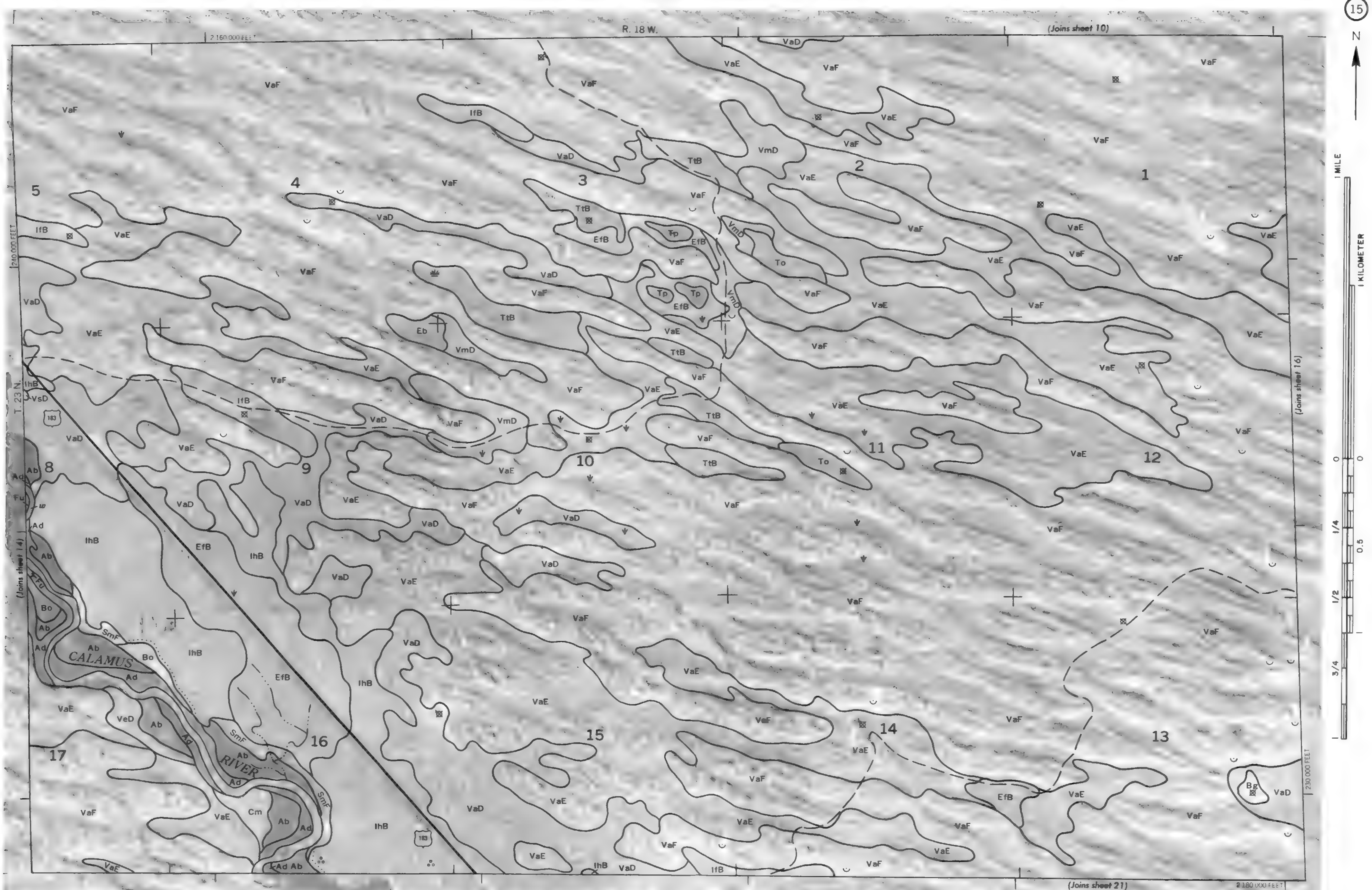

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 7)
R. 20 W.
2 105 000 FEET
240 000 FEET
T. 23 N.
(Joins sheet 13)
(Joins sheet 18)
2 090 000 FEET
BLAINE COUNTY
2
3
5
6
7
8
9
10
11
14
15
16
17
18
VaF
VaE
VaD
IfB
EfB
TtB
Eb
VmD
Bg

13

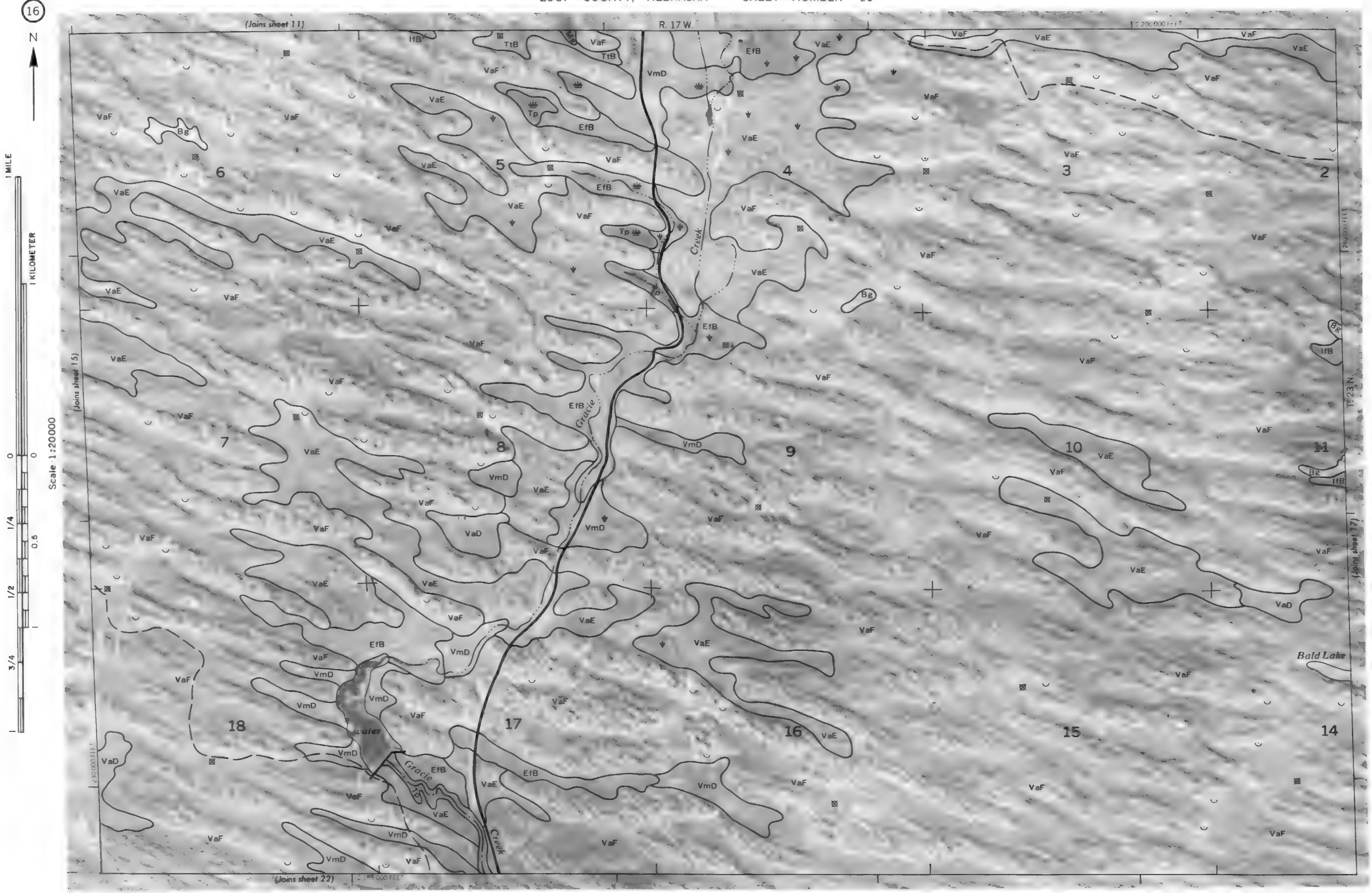


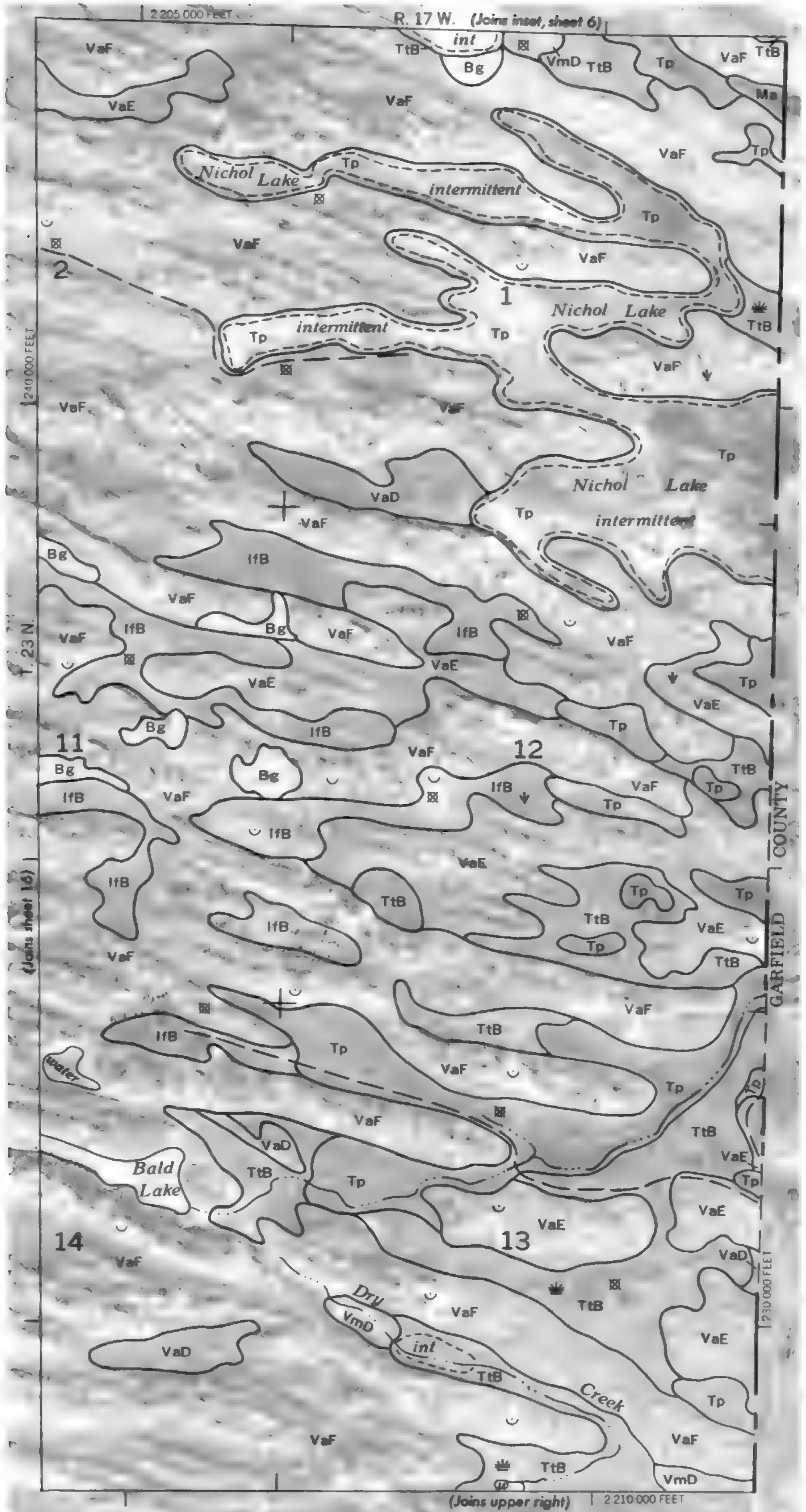
N
R. 20 W.
R. 19 W.
(Joins sheet 8)
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 19)
T. 23 N.
2 110 000 FEET
2 130 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
VaF
VaE
VaD
Bg
EfB
IfB
Tp
TtB
VmD
To
Ma

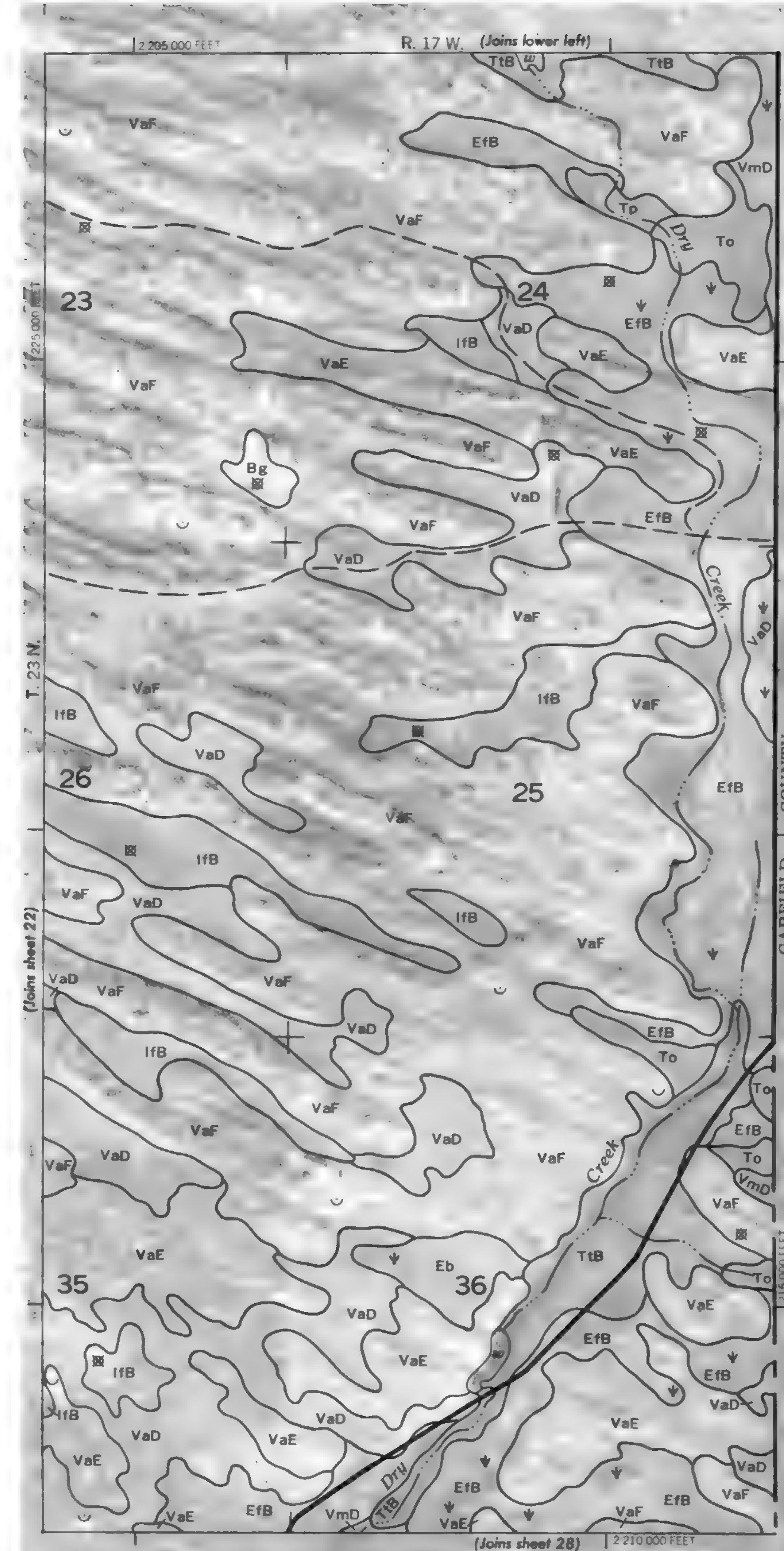

14
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
0.5
1/2
3/4
1
(Joins sheet 9)
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 20)
R. 19 W.
R. 18 W.
T. 23 N.
CALAMUS
RIVER
water
183
1
2
3
5
6
7
8
10
11
12
13
14
15
17
18
VaF
VaE
VaD
VmD
IfB
IhB
EfB
TtB
Tp
To
Bo
Cm
SmB
Pb
Ad
Ab
Fu
VsD
HgF

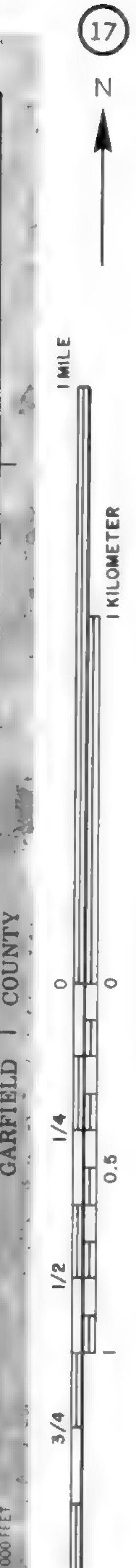


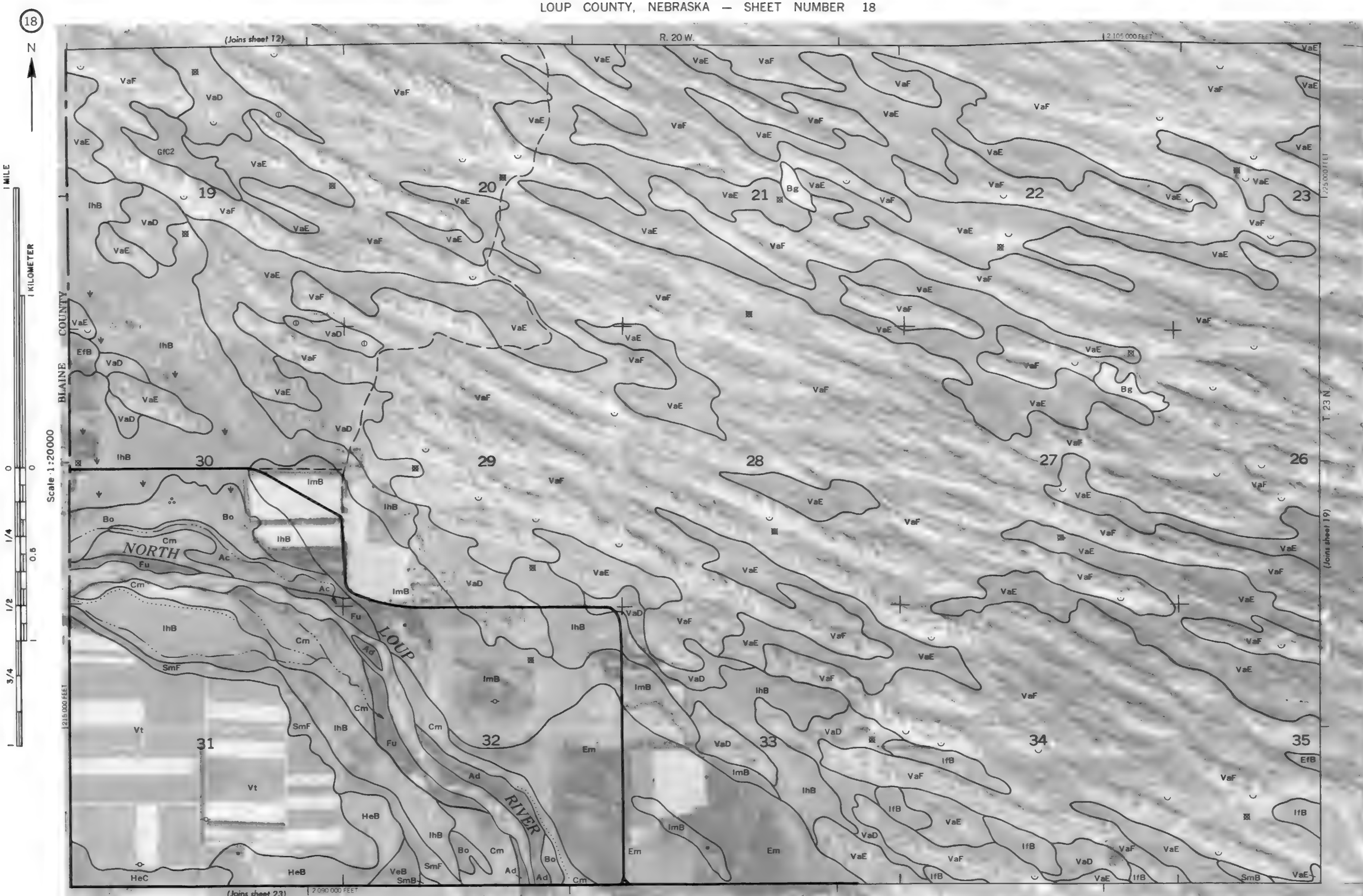
15
N
R. 18 W.
(Joins sheet 10)
(Joins sheet 16)
(Joins sheet 21)
(Joins sheet 14)
T. 23 N.
2 160 000 FEET
240 000 FEET
230 000 FEET
2 180 000 FEET
CALAMUS
RIVER
183
VaF
VaE
VaD
VmD
TtB
EfB
IfB
IhB
Tp
To
Eb
VsD
VeD
Ab
Ad
Fu
Bo
SmF
Cm
Bg
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:20000

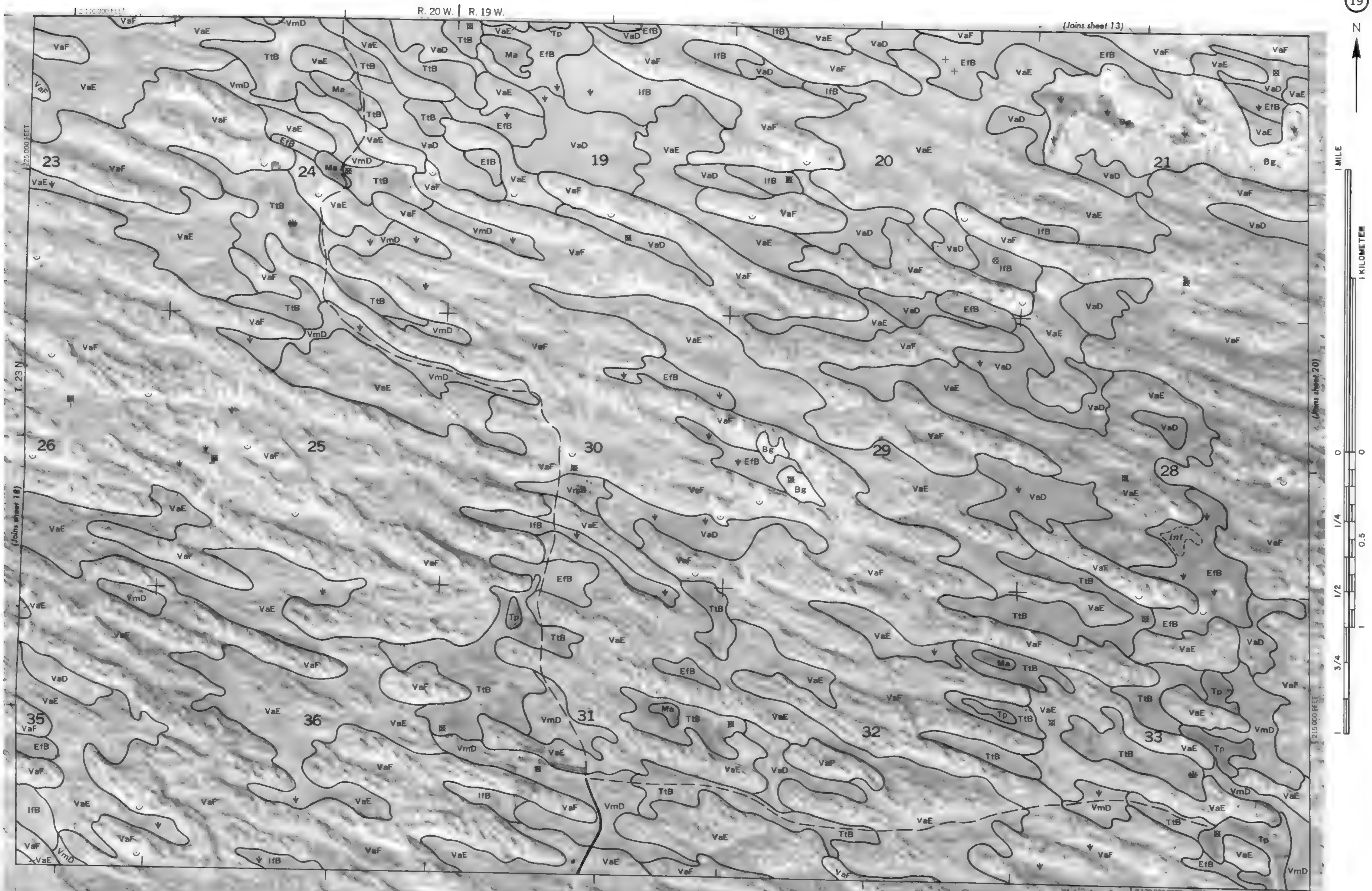

16
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 11)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 22)
R. 17 W.
T. 23 N.
Gracie Creek
Bald Lake
Water
VaF
VaE
VaD
VmD
EfB
IfB
TtB
Tp
Bg
1 2 3 4 5 6 7 8 9 10 11 14 15 16 17 18

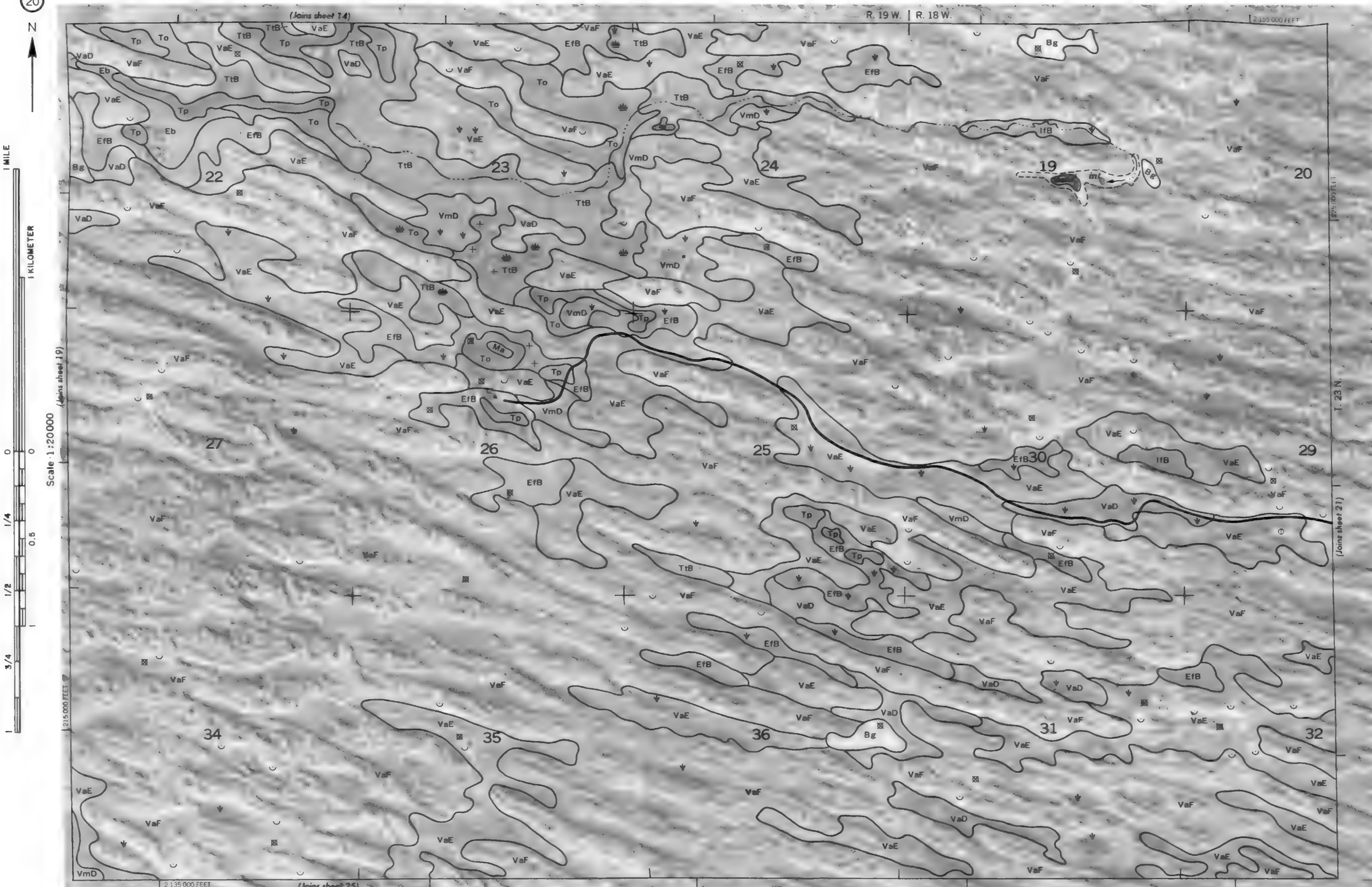

2 205 000 FEET
R. 17 W. (Joins inset, sheet 6)
240 000 FEET
230 000 FEET
T. 23 N.
(Joins sheet 16)
GARFIELD COUNTY
(Joins upper right)
2 210 000 FEET
Nichol Lake
intermittent
Bald Lake
Dry Creek
water
2
1
11
12
14
13

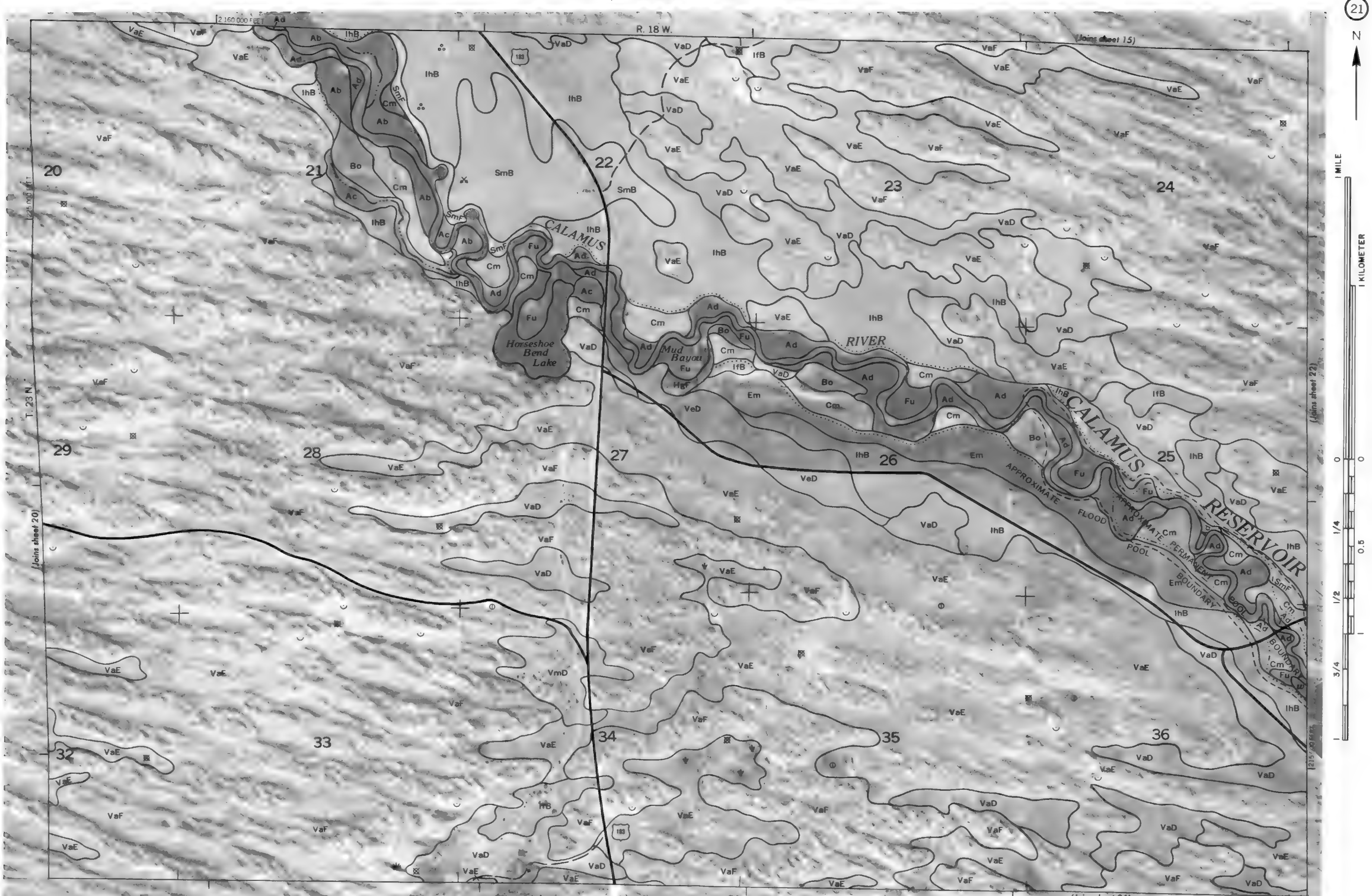

2 205 000 FEET
R. 17 W. (Joins lower left)
225 000 FEET
215 000 FEET
T. 23 N.
(Joins sheet 22)
GARFIELD COUNTY
(Joins sheet 28)
2 210 000 FEET
Dry Creek
23
24
26
25
35
36

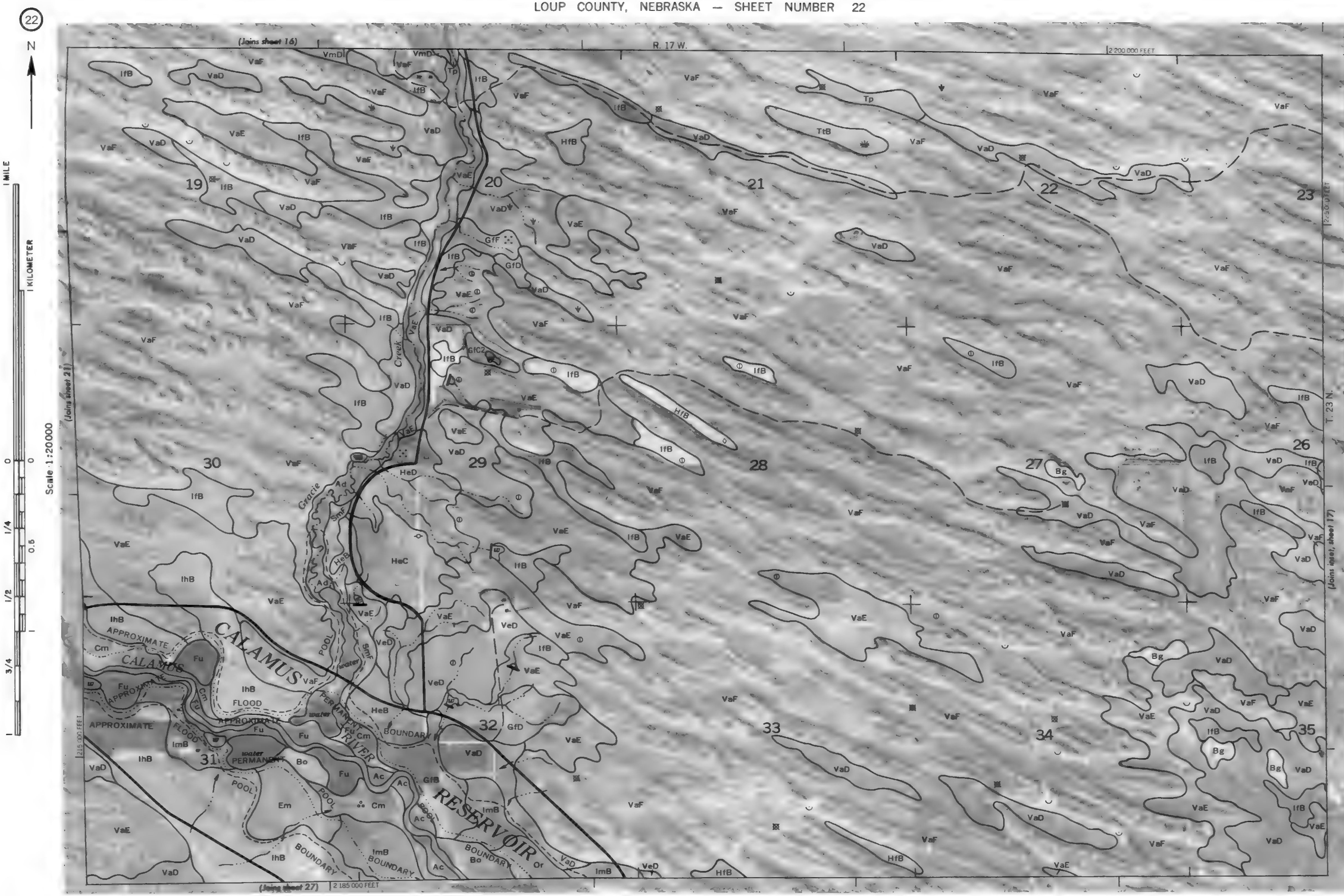

17
N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
1
Scale 1:20000

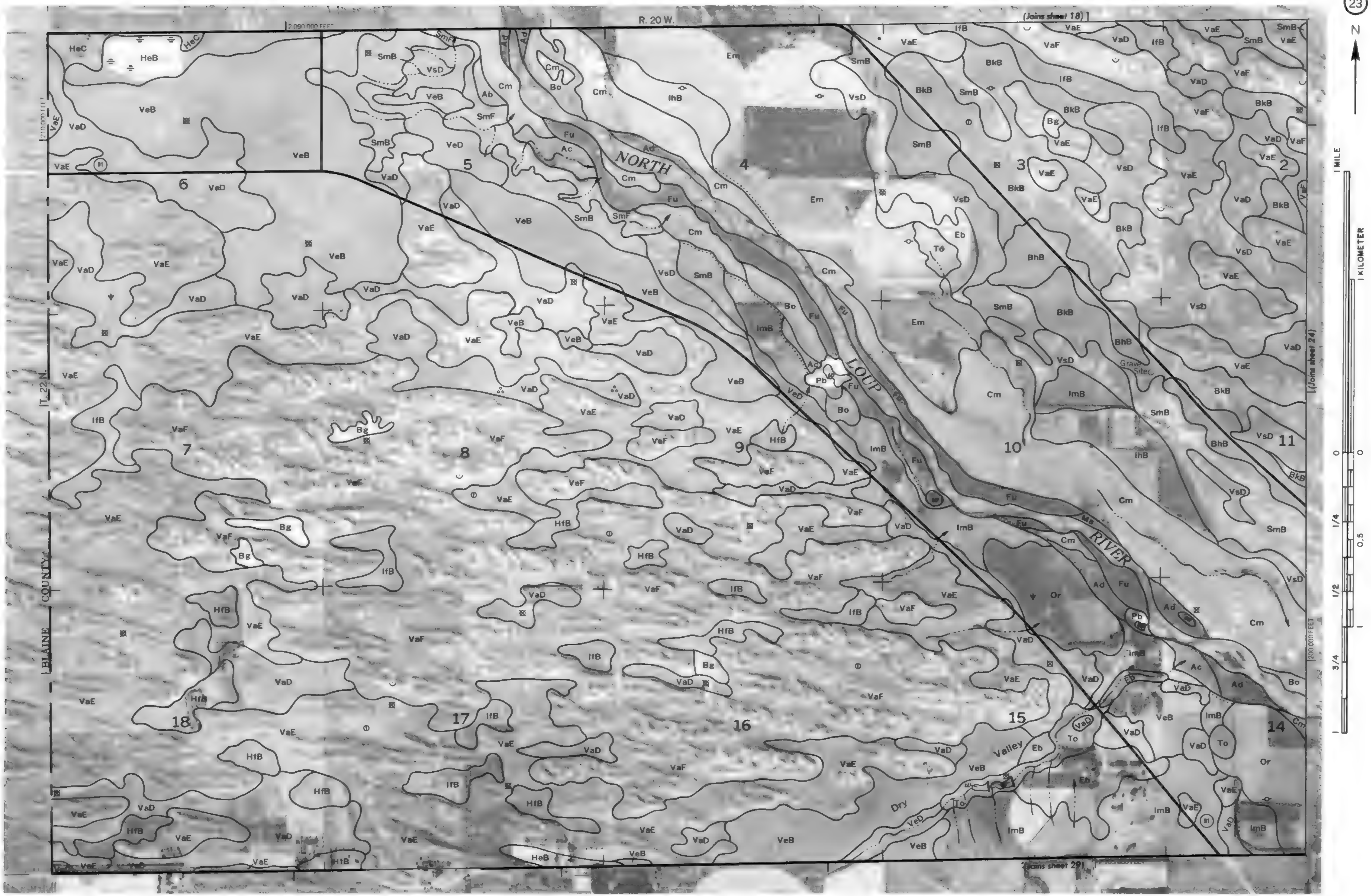

18
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 12)
R. 20 W.
2 105 000 FEET
T. 23 N.
(Joins sheet 19)
(Joins sheet 23)
2 090 000 FEET
215 000 FEET
BLAINE COUNTY
NORTH LOUP RIVER
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35

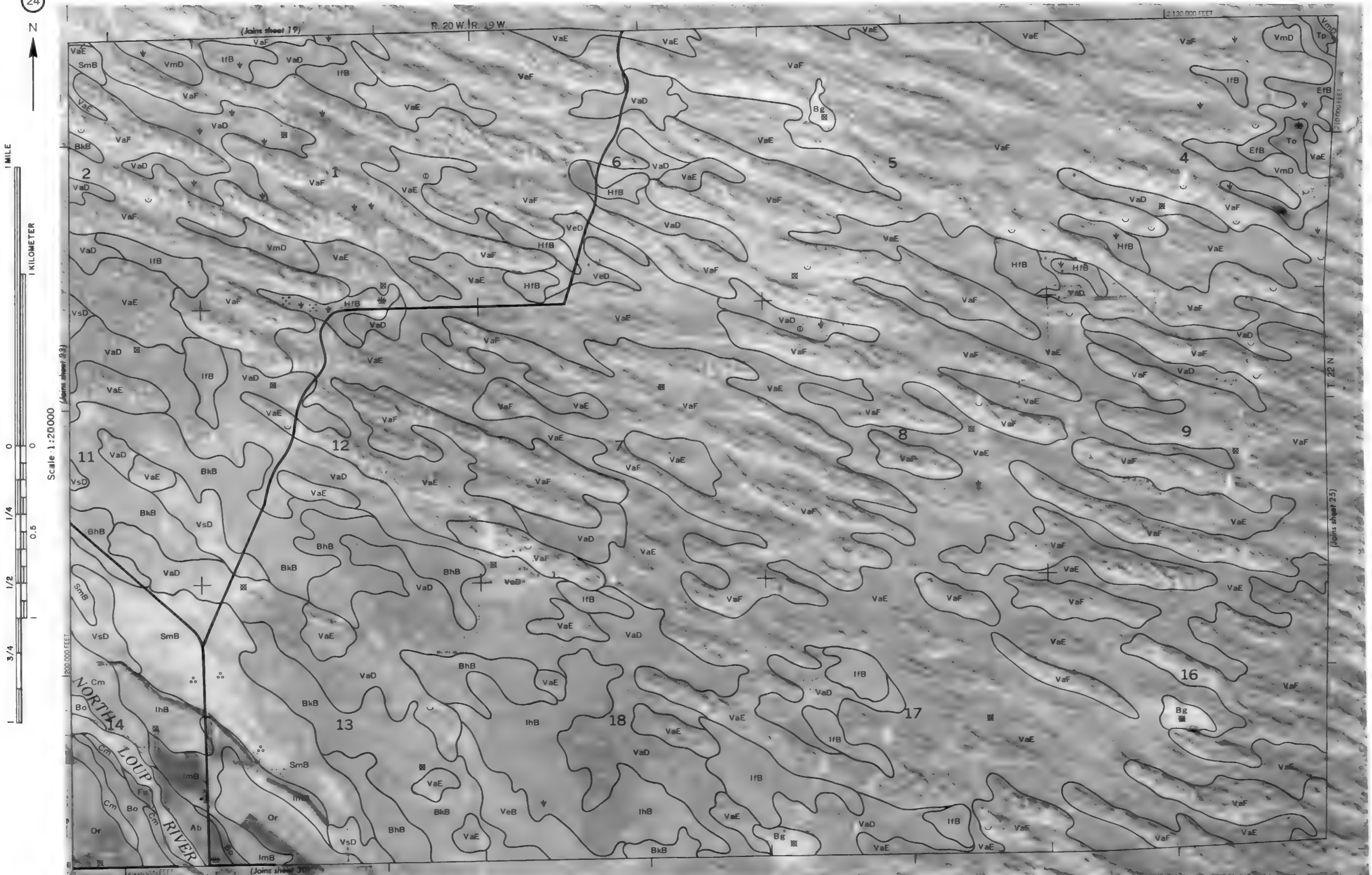

19
N
R. 20 W.
R. 19 W.
(Joins sheet 13)
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 24)
T. 23 N.
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

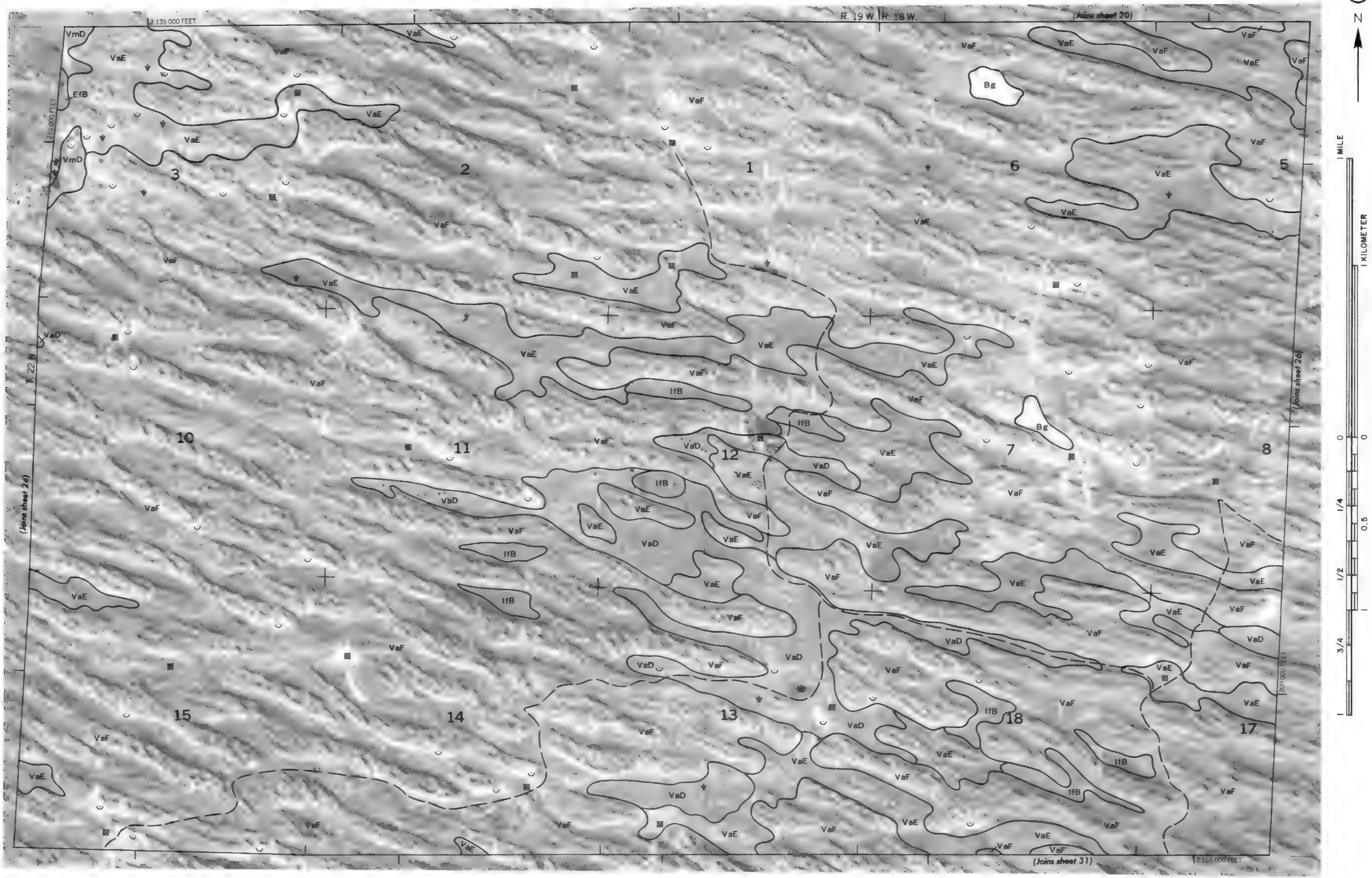

20
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 14)
R. 19 W. | R. 18 W.
2 155 000 FEET
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 25)
T. 23 N.
2 135 000 FEET
215 000 FEET
225 000 FEET
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32

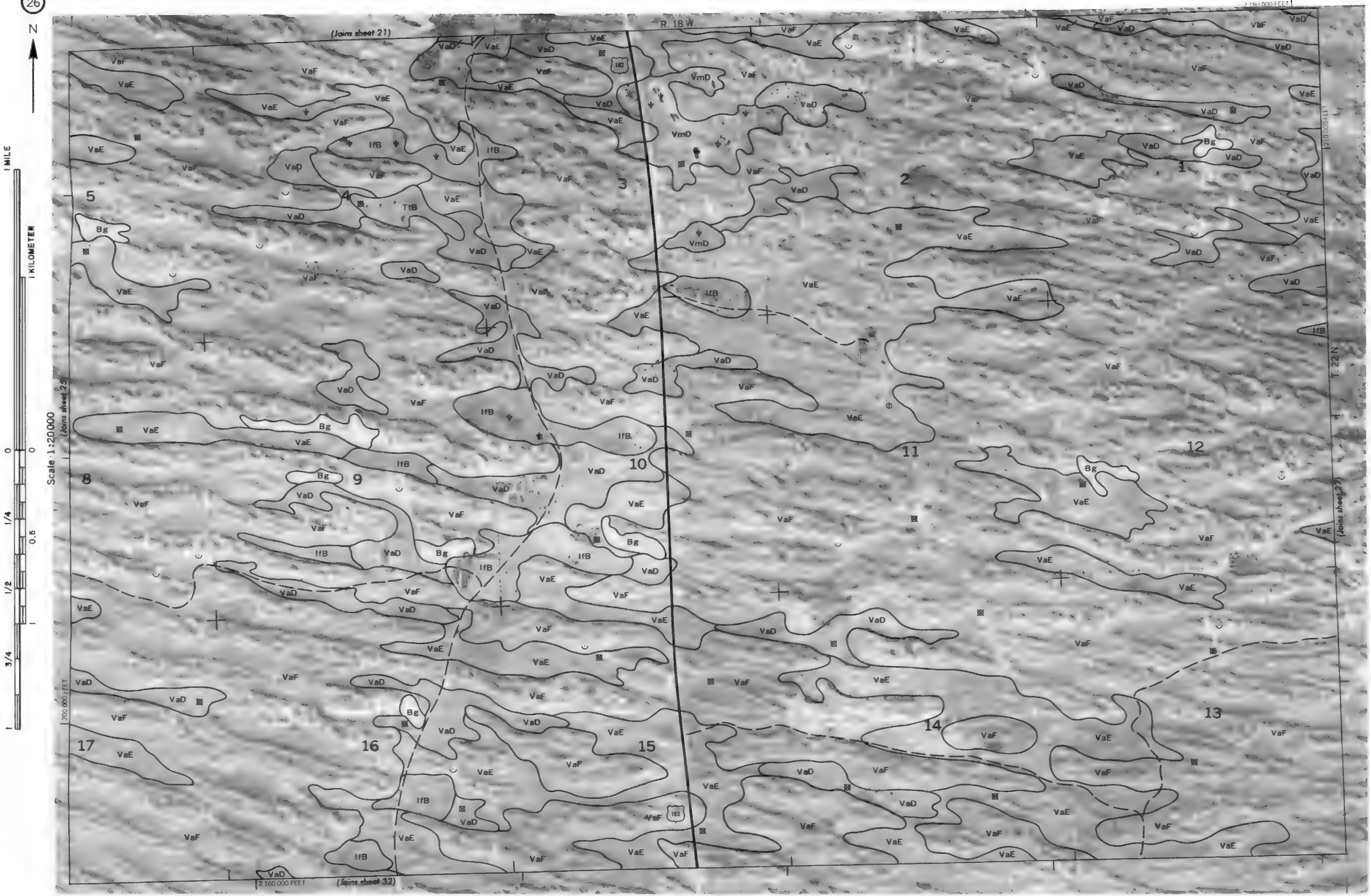

21
N
R. 18 W.
T. 23 N.
2 160 000 FEET
2 180 000 FEET
(Joins sheet 15)
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 26)
CALAMUS RIVER
CALAMUS RESERVOIR
Horseshoe Bend Lake
Mud Bayou
APPROXIMATE FLOOD POOL
APPROXIMATE PERMANENT POOL BOUNDARY
183
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:20000


22
N
(Joins sheet 16)
R. 17 W.
2 200 000 FEET
(Joins sheet 21)
(Joins sheet 17)
T. 23 N.
(Joins sheet 27)
2 185 000 FEET
Scale 1:20000
1 MILE
1 KILOMETER
CALAMUS RESERVOIR
Gracie Creek
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35


N
R. 20 W.
(Joins sheet 18)
(Joins sheet 24)
(Joins sheet 29)
T. 22 N.
BLAINE COUNTY
NORTH LOUP RIVER
Dry Valley
Gravel Site
2 090 000 FEET
210 000 FEET
200 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000


N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 19)
R. 20 W. | R. 19 W.
2 130 000 FEET
T. 22 N.
(Joins sheet 25)
(Joins sheet 23)
(Joins sheet 30)
NORTH LOUP RIVER
200 000 FEET

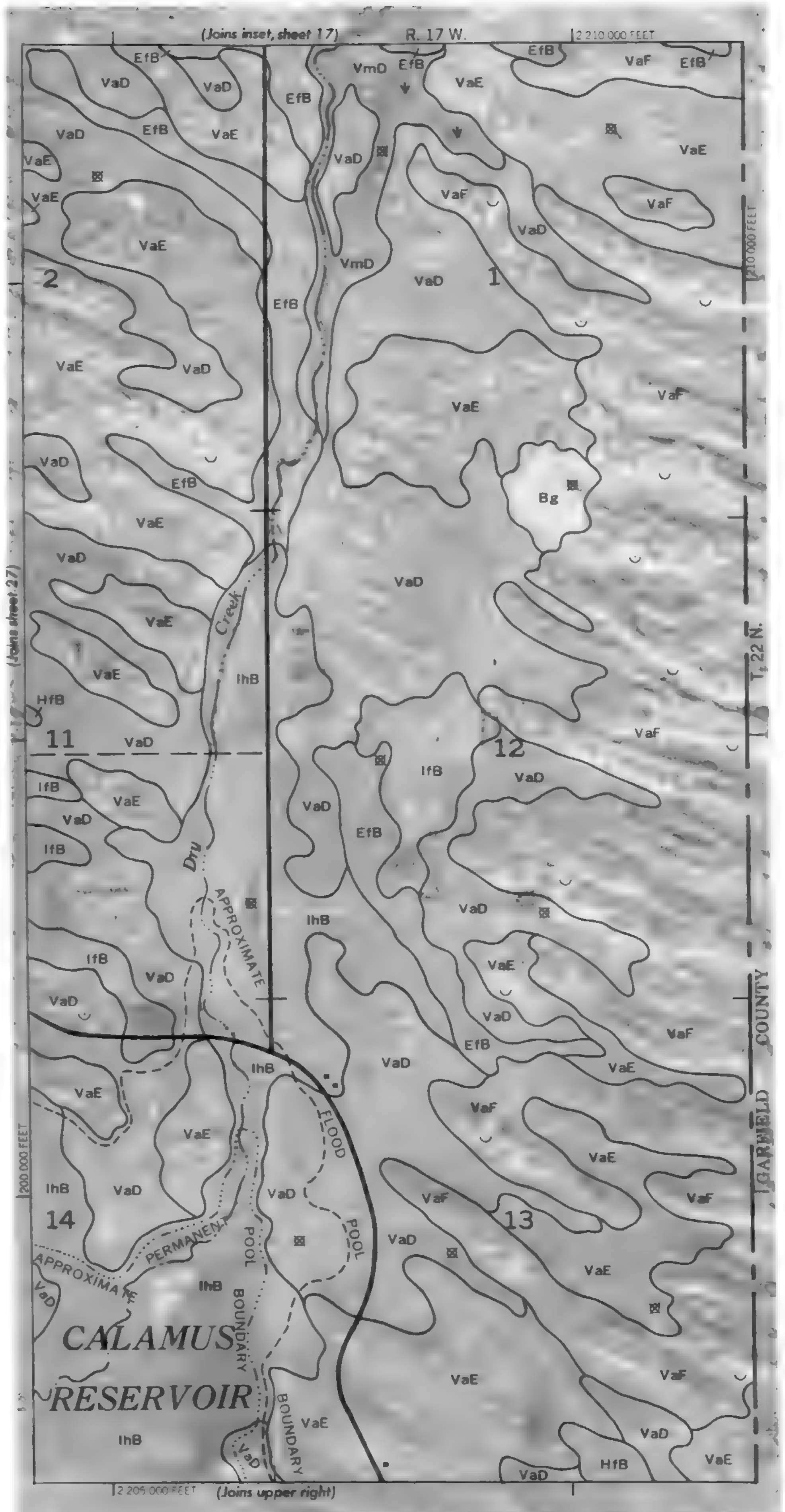

N
2 135 000 FEET
R. 19 W. R. 18 W.
(Joins sheet 20)
210 000 FEET
T. 22 N.
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 31)
2 155 000 FEET
1
2
3
5
6
7
8
10
11
12
13
14
15
17
18
VmD
EfB
VaE
VaF
VaD
IfB
Bg
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0.5
Scale 1:20000

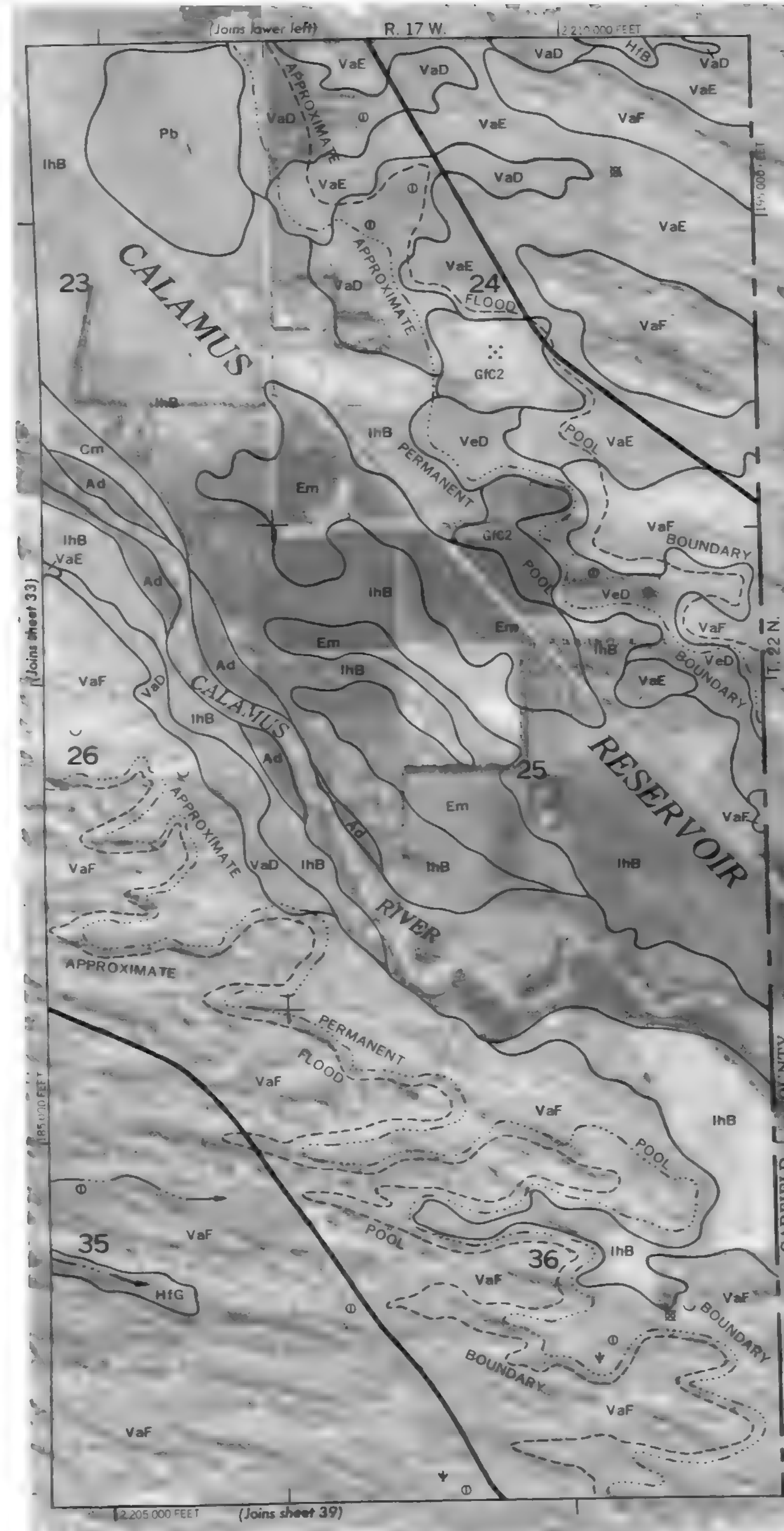

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
(Joins sheet 21)
R. 18 W.
T. 22 N.
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 32)
2 160 000 FEET
2 180 000 FEET
210 000 FEET
200 000 FEET
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
183

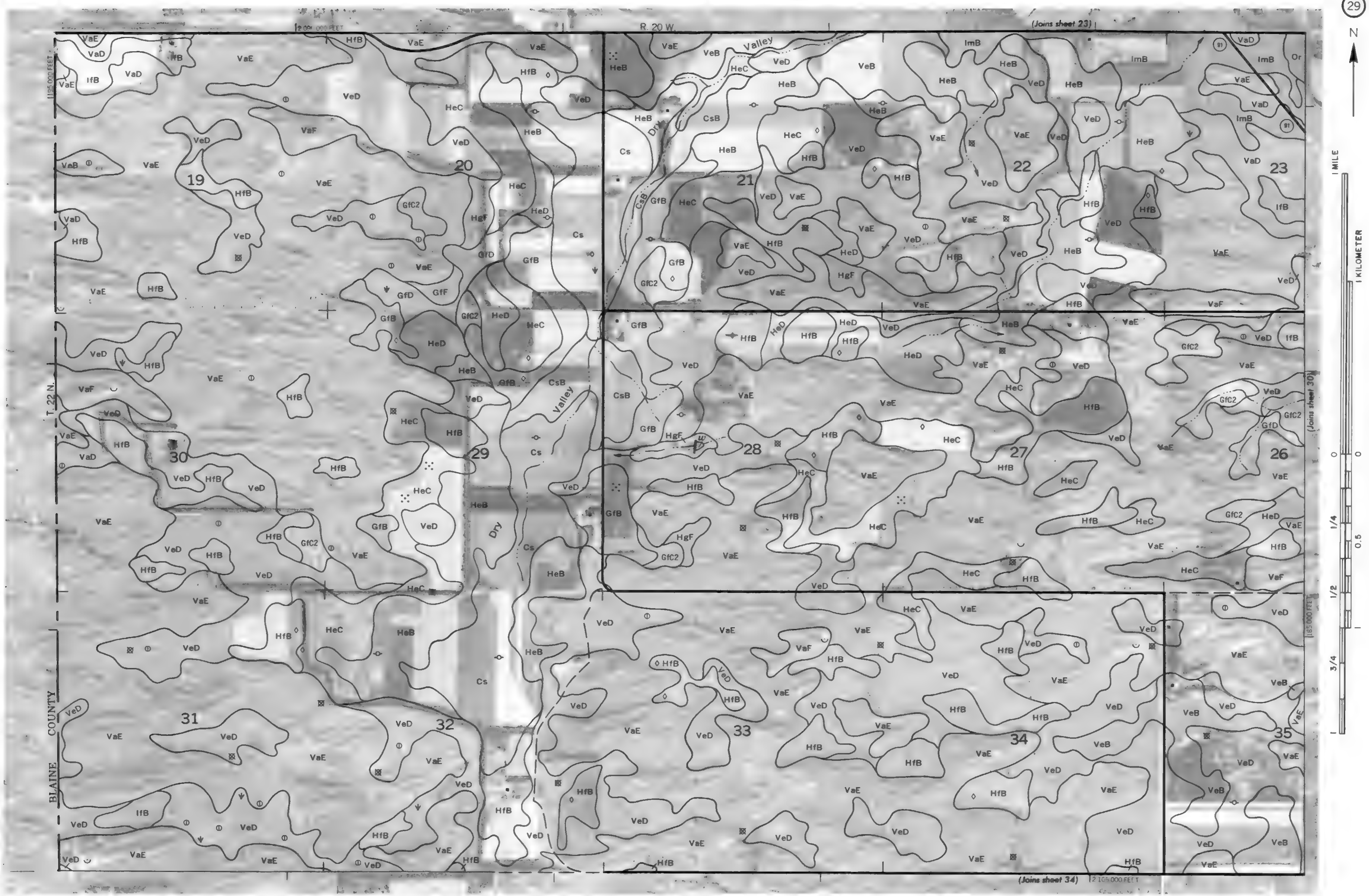

27
N
(Joins sheet 22)
(Joins sheet 28)
(Joins sheet 33)
(Joins sheet 26)
R. 17 W.
T. 22 N.
CALAMUS
CALAMUS RIVER
RESERVOIR
PERMANENT POOL BOUNDARY
FLOOD POOL BOUNDARY
APPROXIMATE
Scherzberg Bayou
Dry Creek
1 MILE
1 KILOMETER
Scale 1:20000

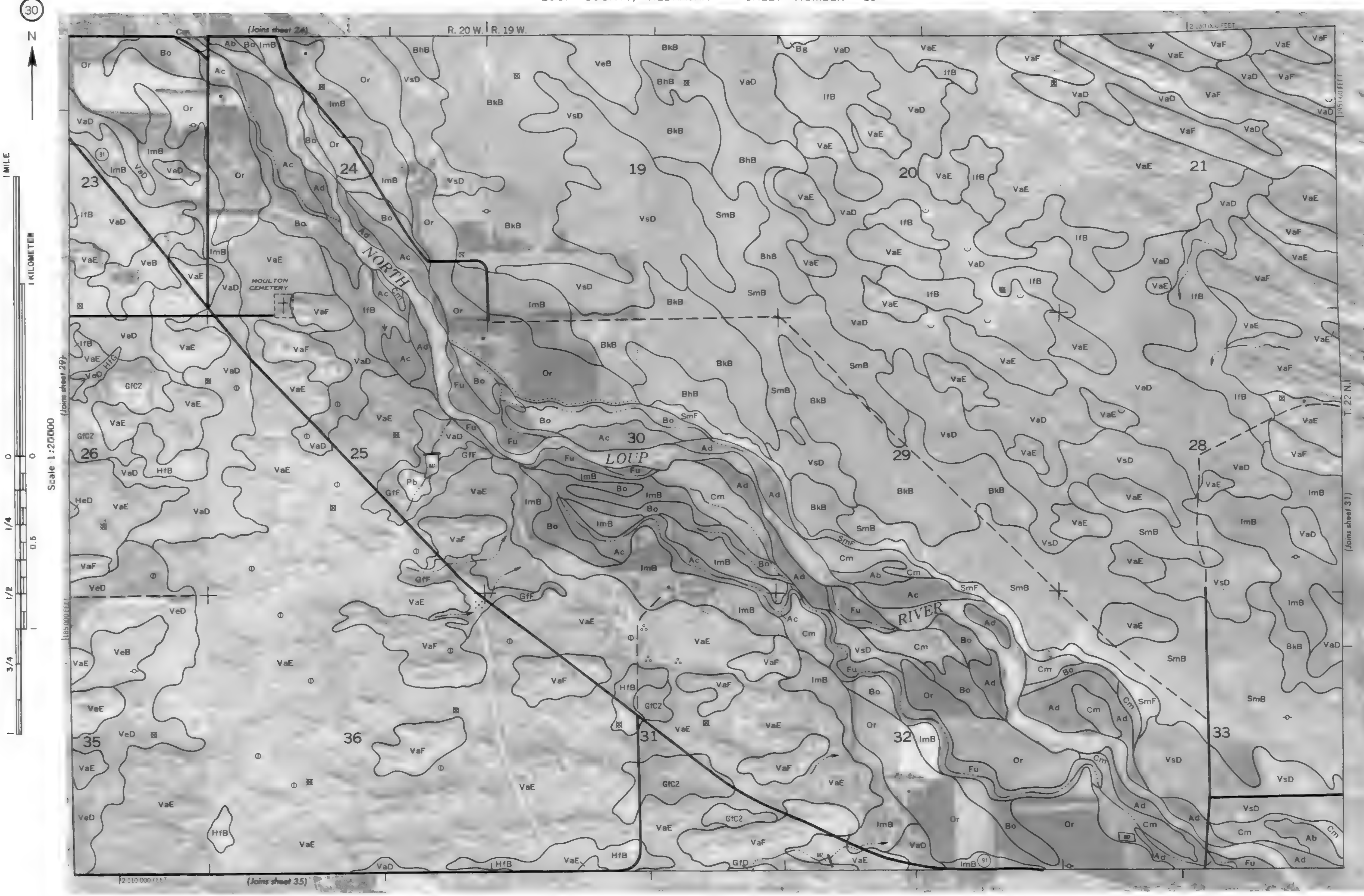
28

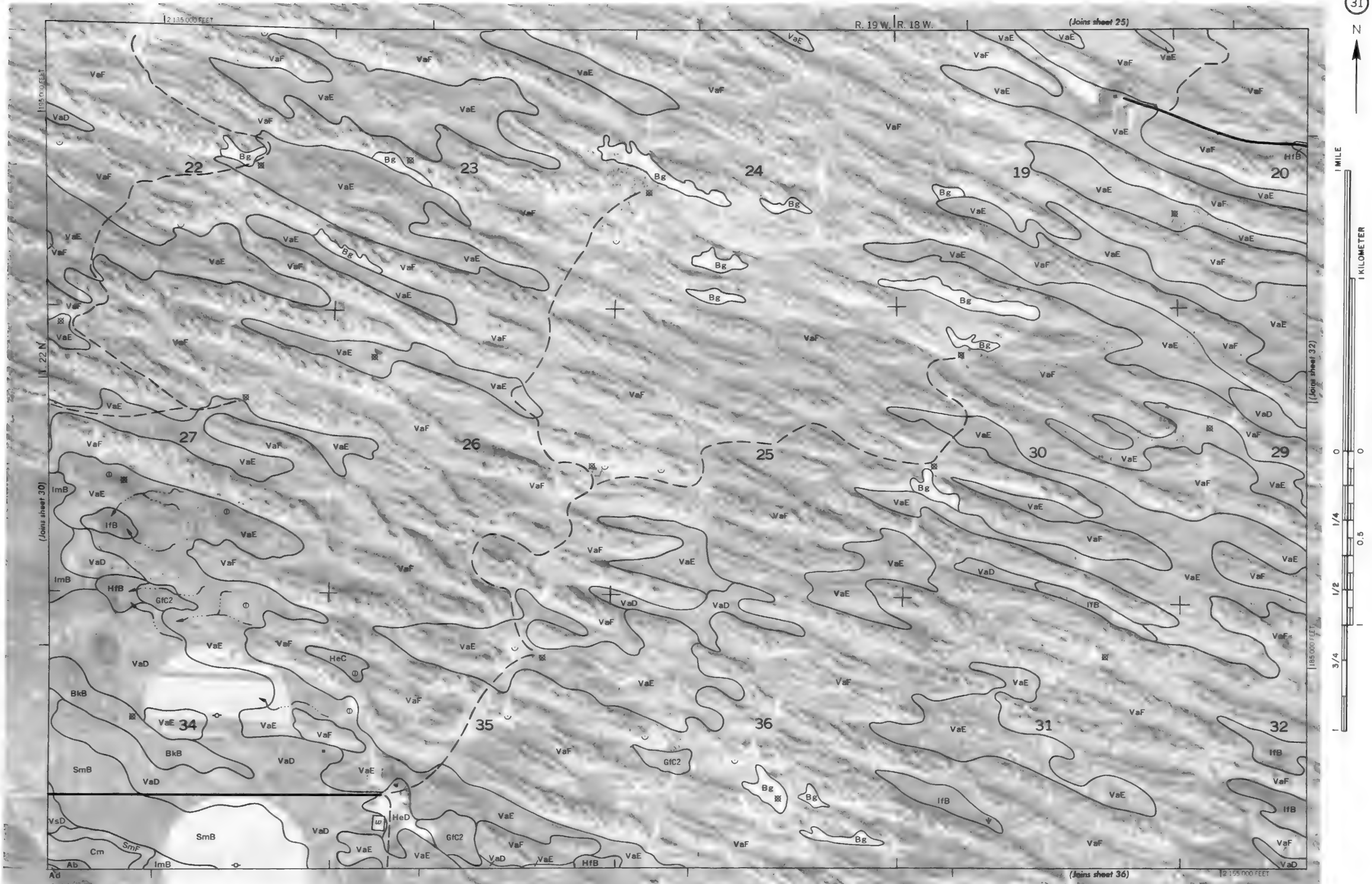

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1

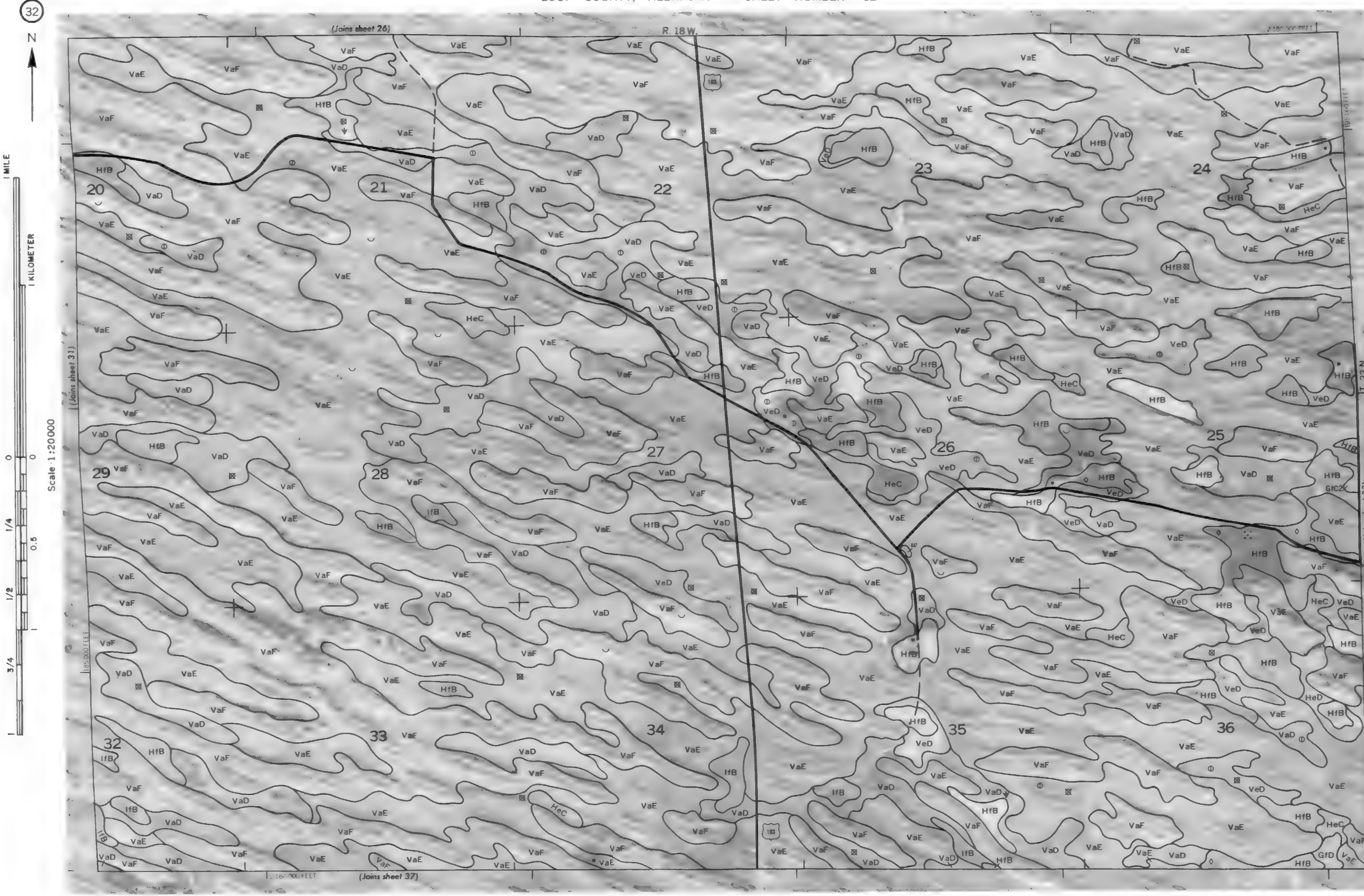

(Joins inset, sheet 17)
R. 17 W.
2 210 000 FEET
(Joins sheet 27)
T. 22 N.
GARFIELD COUNTY
(Joins upper right)
2 205 000 FEET
Dry Creek
APPROXIMATE
PERMANENT
FLOOD
POOL
BOUNDARY
CALAMUS
RESERVOIR
1
2
11
12
13
14

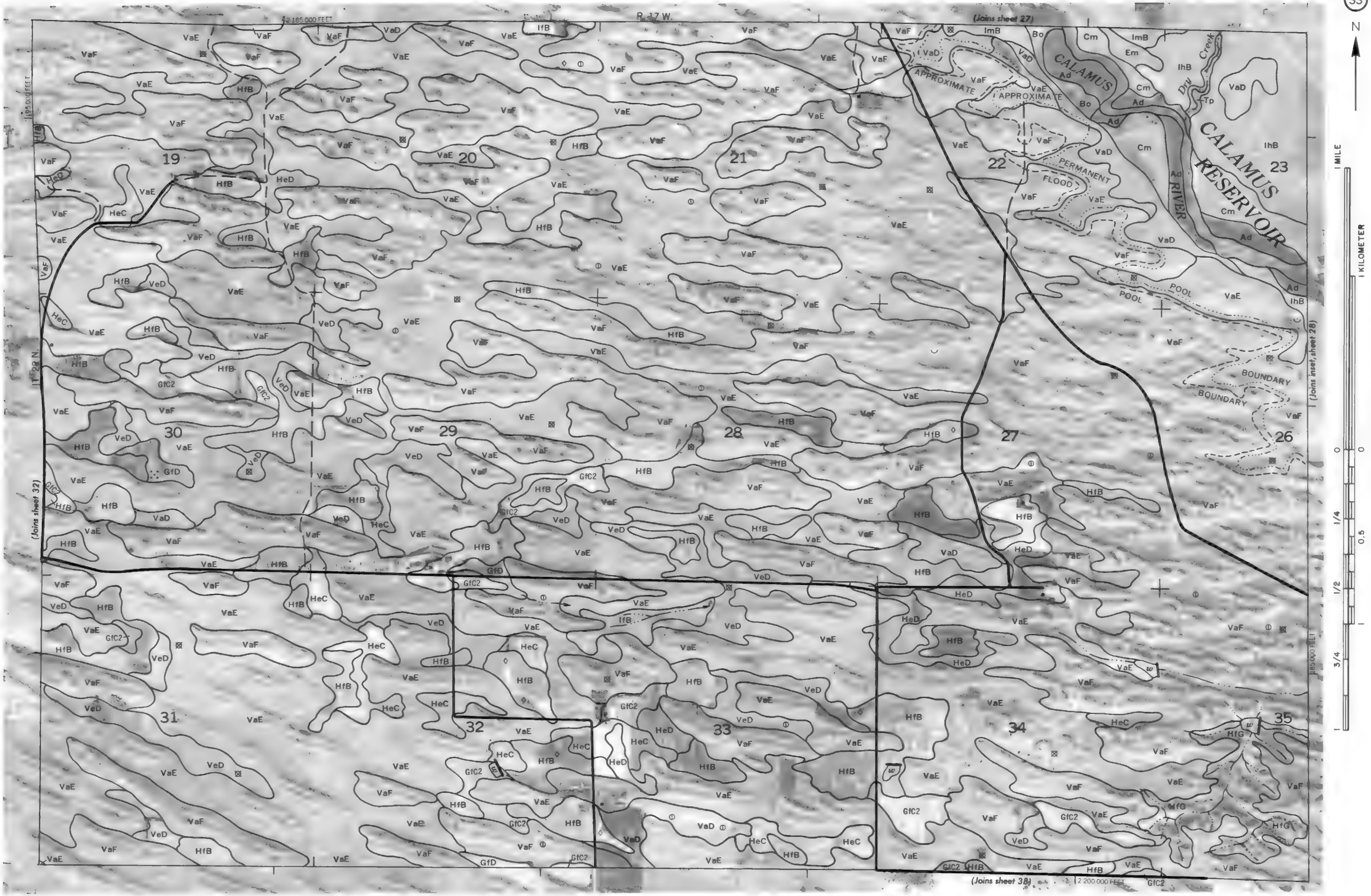

(Joins lower left)
R. 17 W.
(Joins sheet 33)
T. 22 N.
GARFIELD COUNTY
2 205 000 FEET
(Joins sheet 39)
CALAMUS
RESERVOIR
CALAMUS
RIVER
APPROXIMATE
PERMANENT
FLOOD
POOL
BOUNDARY
23
24
25
26
35
36

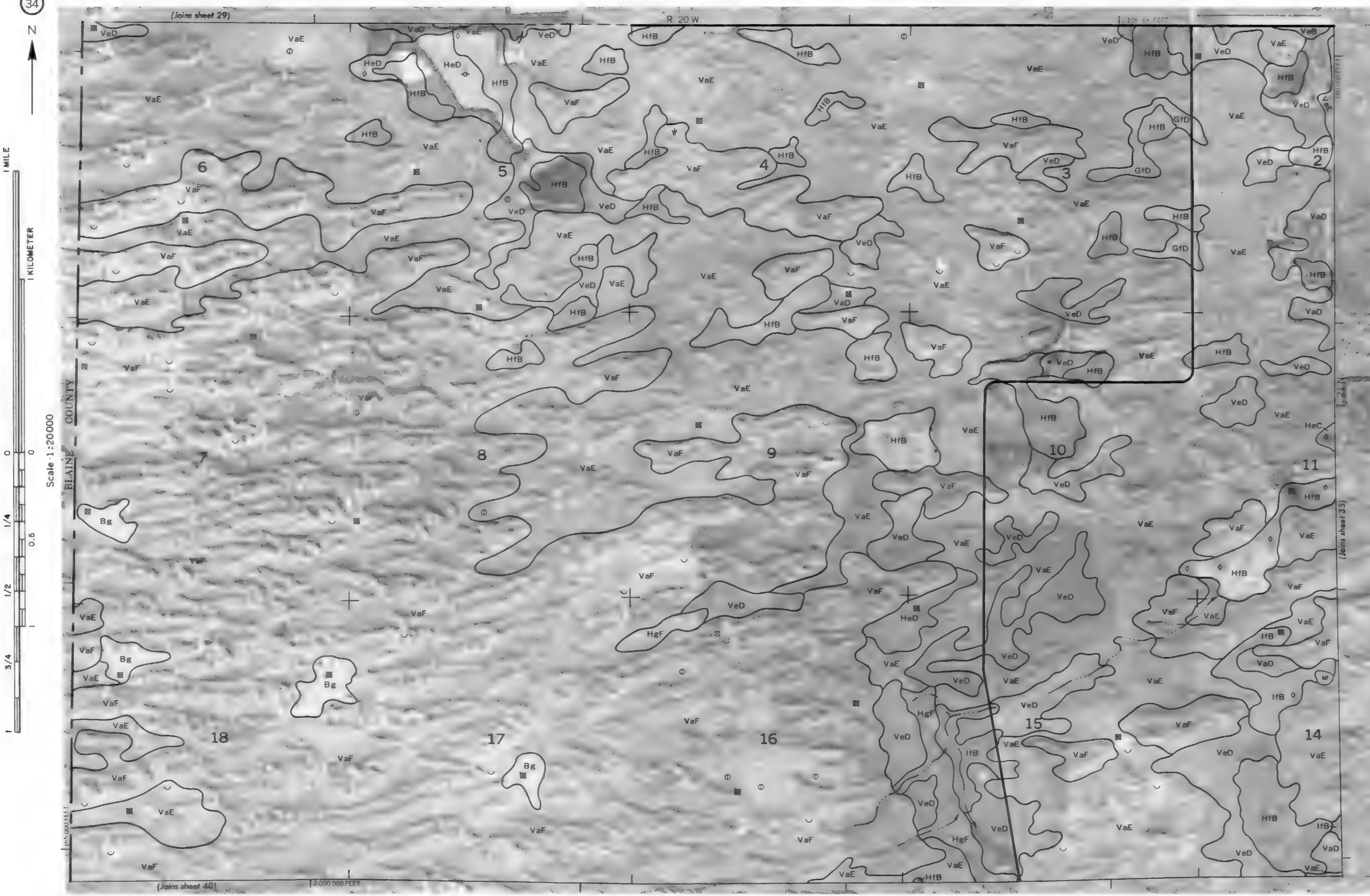

29
N
R. 20 W.
(Joins sheet 23)
(Joins sheet 30)
(Joins sheet 34)
T. 22 N.
BLAINE COUNTY
Dry Valley
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

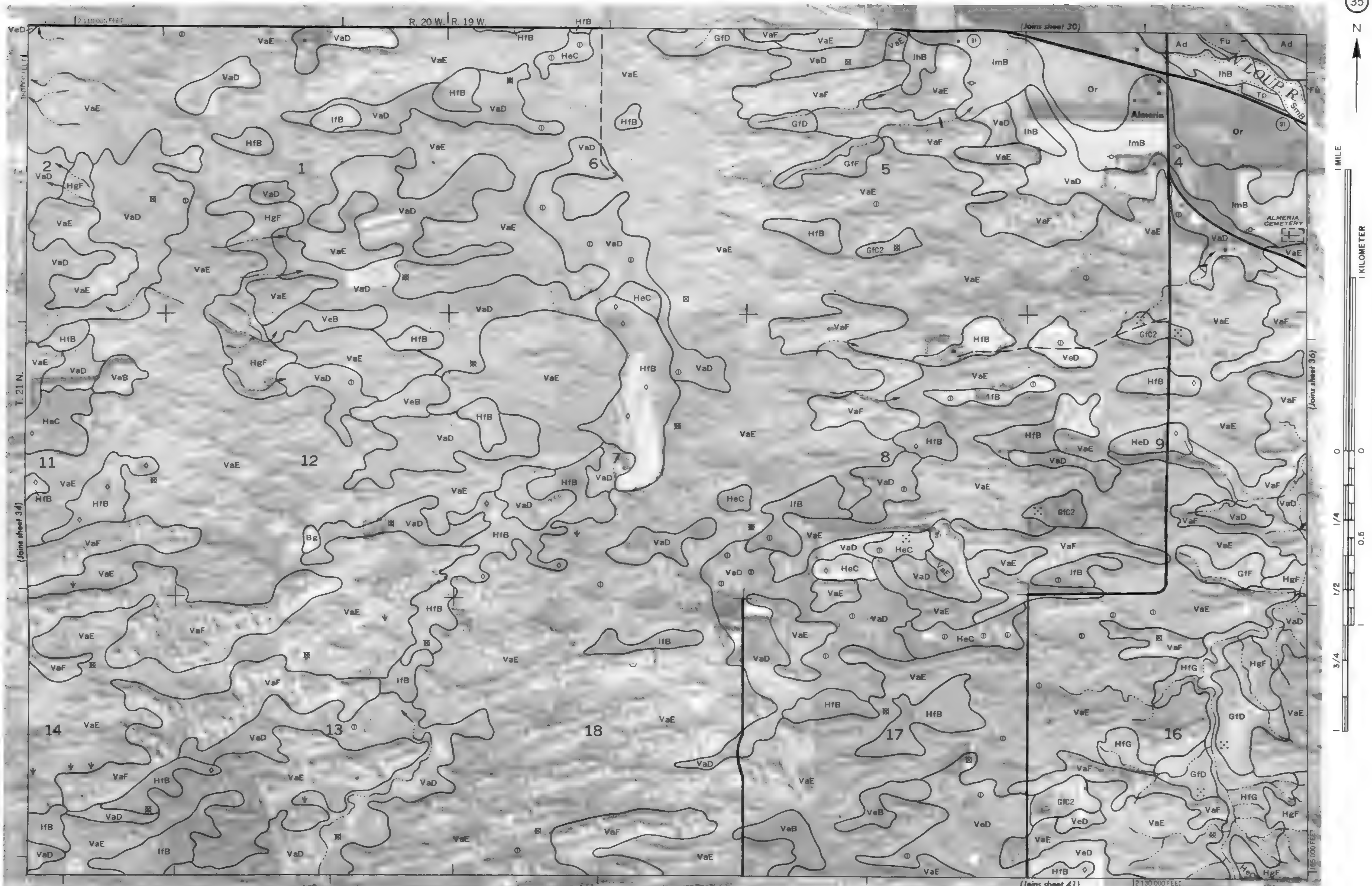

30
N
(Joins sheet 24)
R. 20 W.
R. 19 W.
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 35)
T. 22 N.
Scale 1:20000
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
MOULTON CEMETERY
NORTH
LOUP
RIVER
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

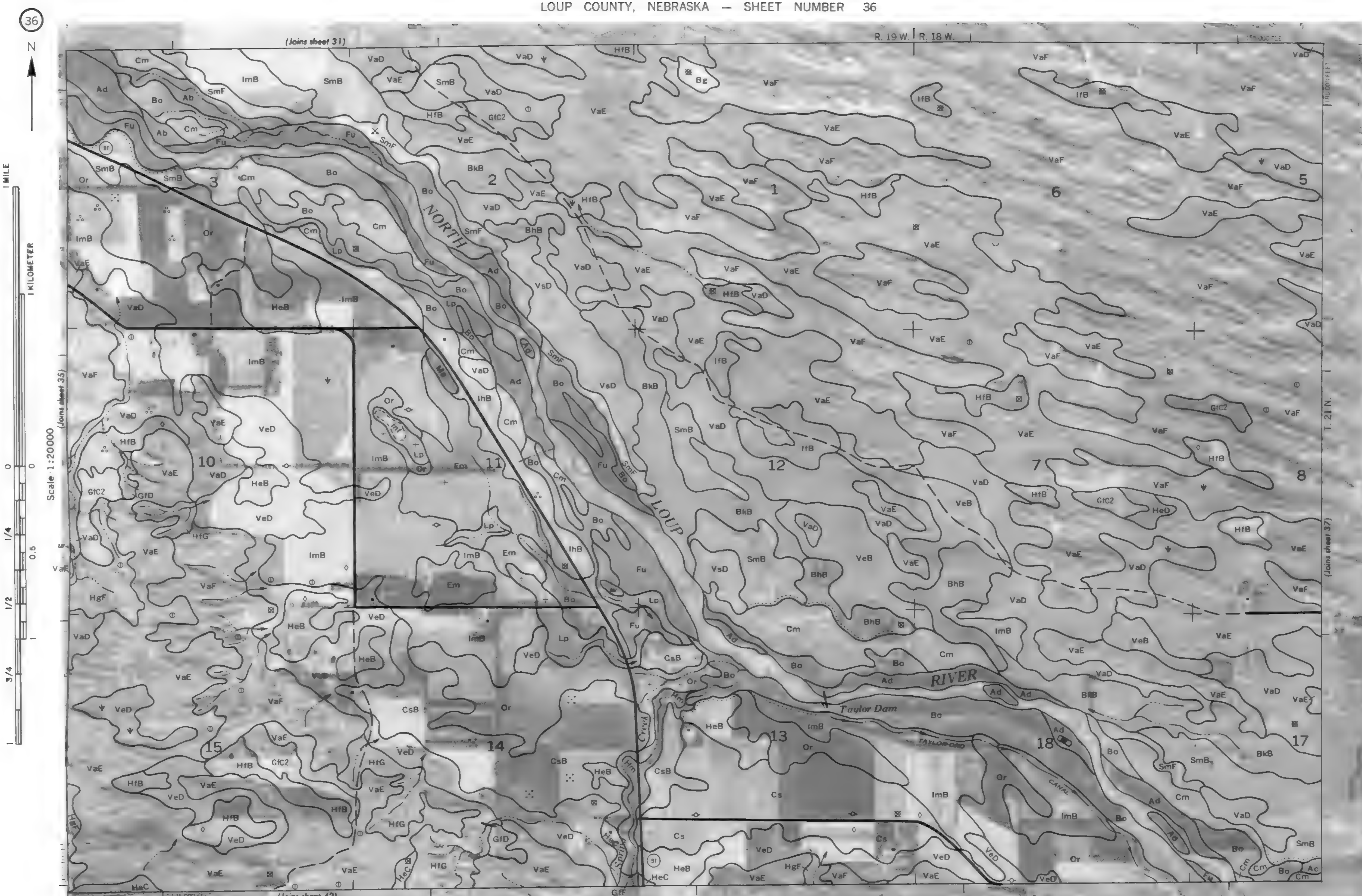

31
N
(Joins sheet 25)
(Joins sheet 36)
(Joins sheet 30)
(Joins sheet 32)
R. 19 W. | R. 18 W.
T. 22 N.
2 135 000 FEET
2 155 000 FEET
195 000 FEET
185 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32

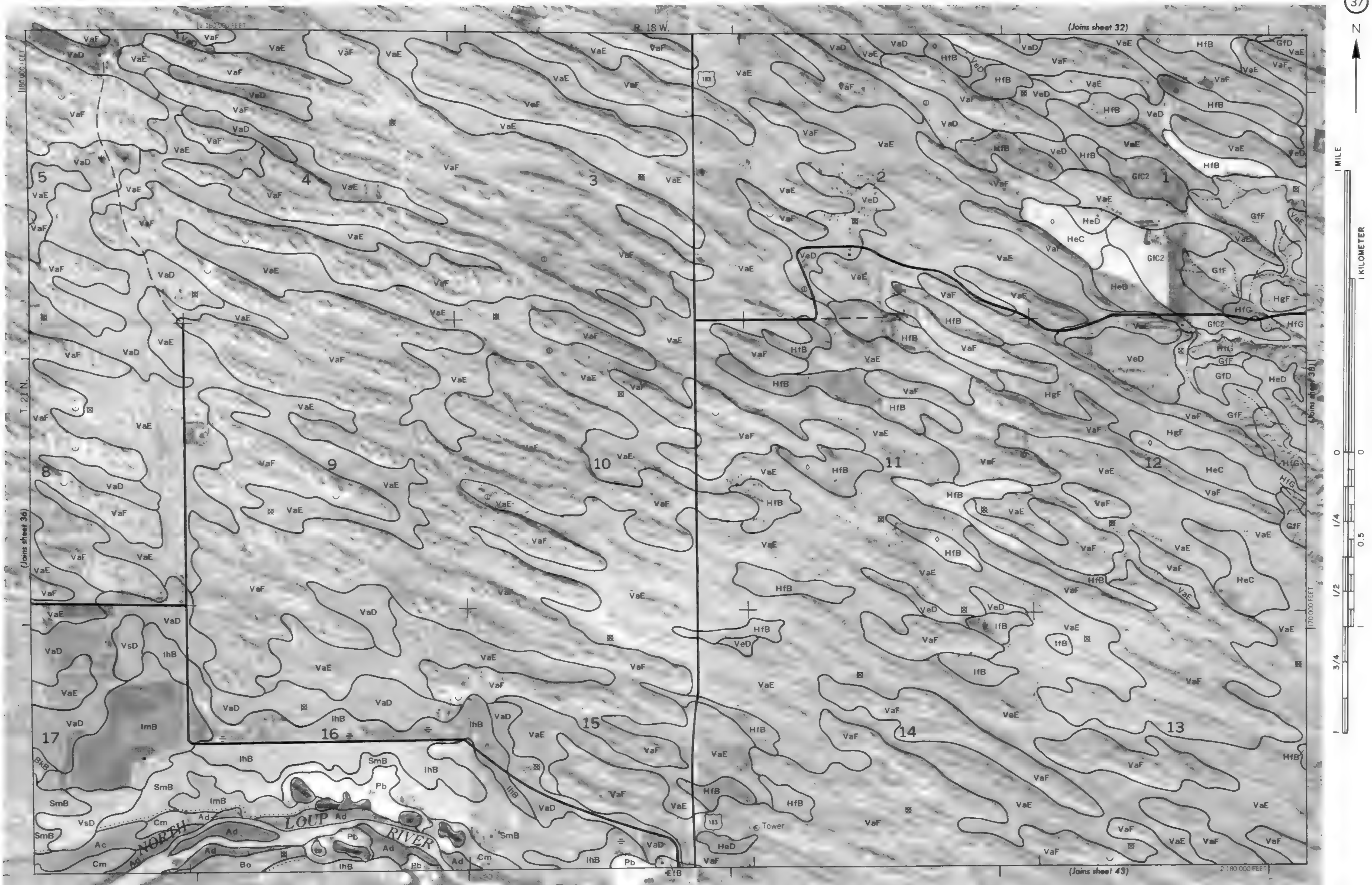

32
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 26)
R. 18 W.
(Joins sheet 31)
(Joins sheet 33)
T. 22 N.
(Joins sheet 37)
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
183

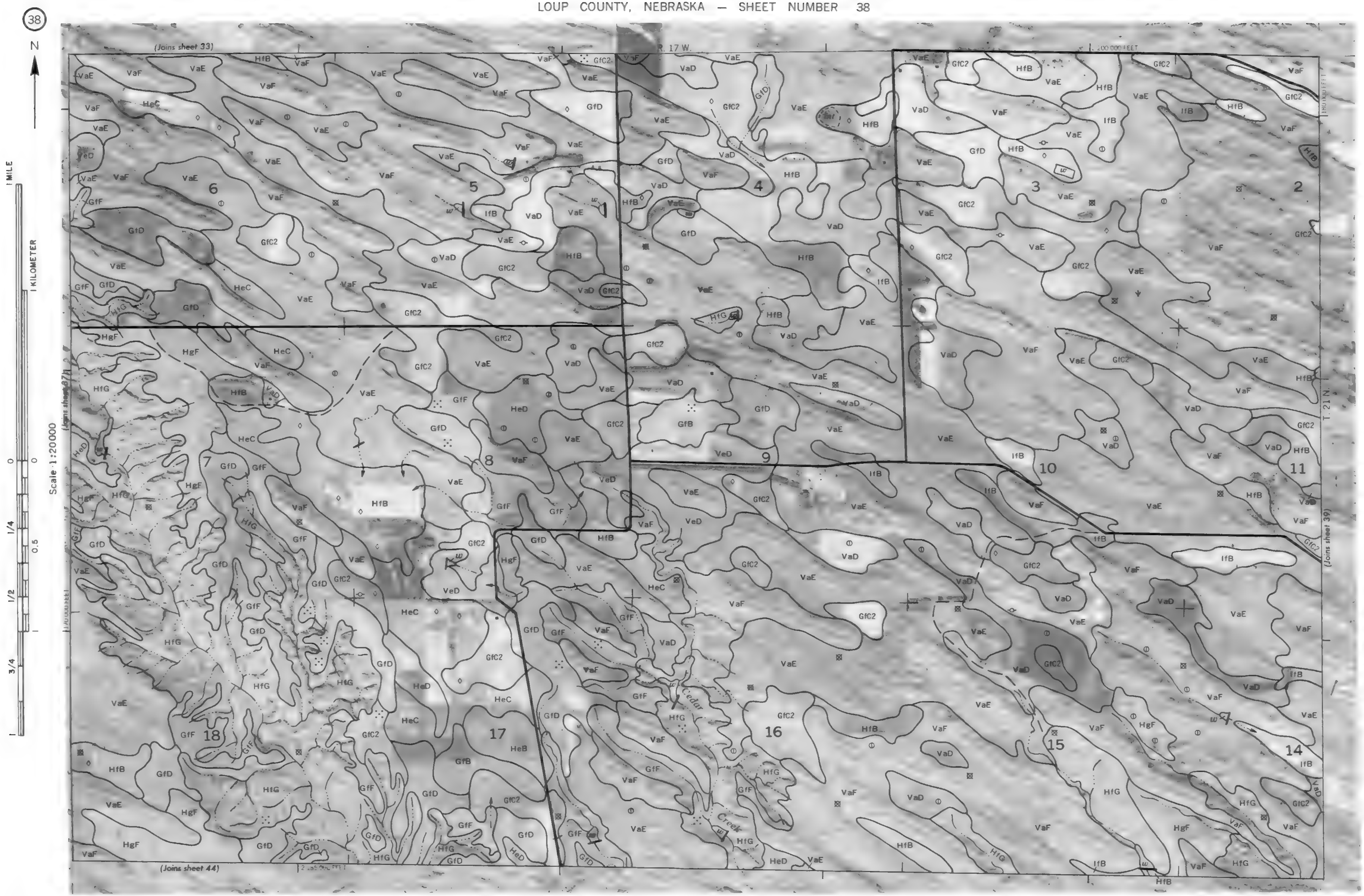

(Joins sheet 27)
(Joins sheet 32)
(Joins inset, sheet 28)
(Joins sheet 38)
R. 17 W.
T. 22 N.
2 185 000 FEET
2 200 000 FEET
CALAMUS RESERVOIR
CALAMUS RIVER
Dry Creek
APPROXIMATE PERMANENT FLOOD POOL BOUNDARY
N
1 MILE
1 KILOMETER
Scale 1:20000

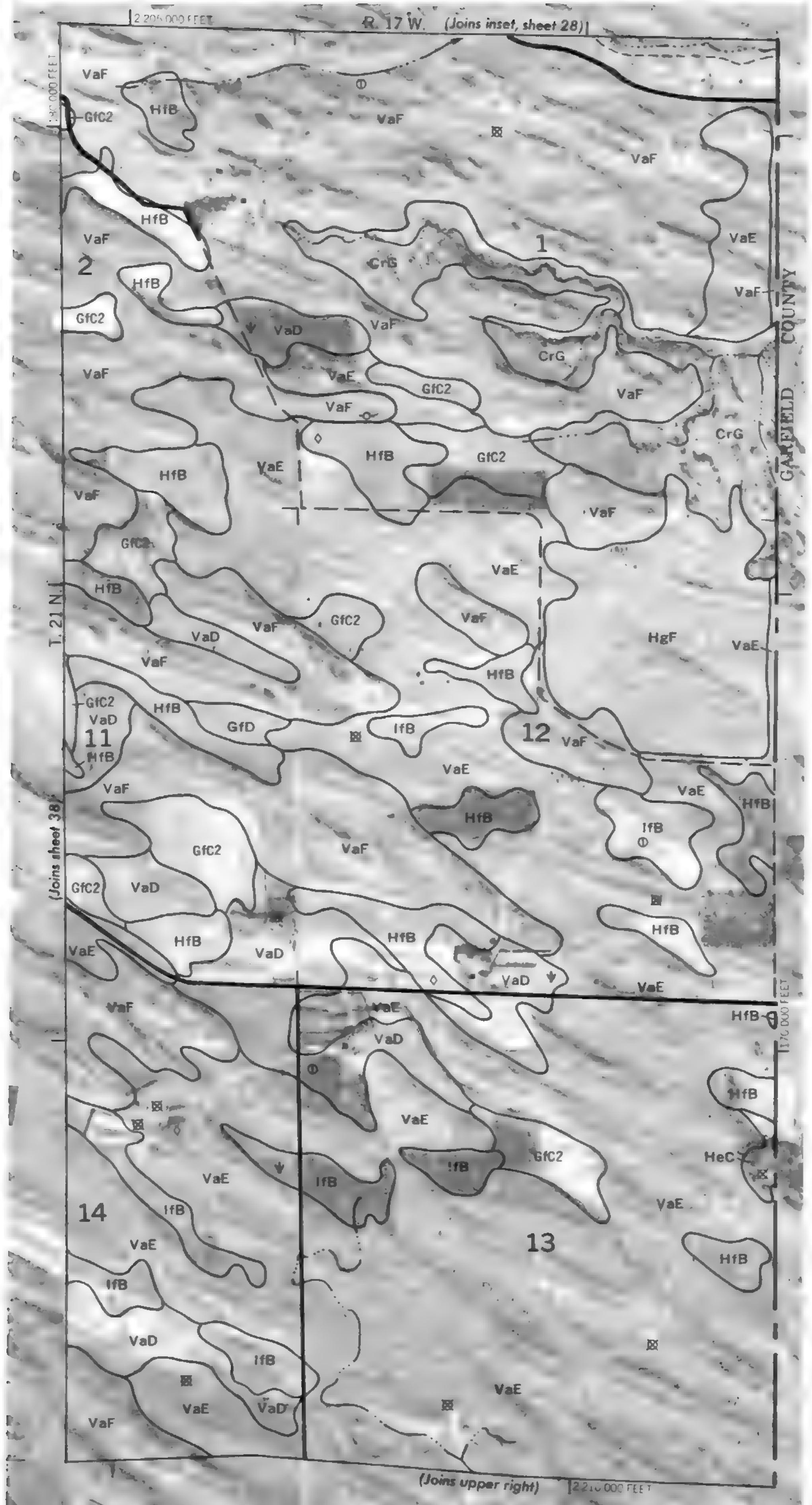

(Joins sheet 29)
R. 20 W.
(Joins sheet 35)
(Joins sheet 40)
2 090 000 FEET
BLAINE COUNTY
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18
VaE
VaF
VeD
HfB
HeD
GfD
VaD
HgF
HeC
IfB
Bg


35
N
R. 20 W.
R. 19 W.
(Joins sheet 30)
N LOUP R
Almeria
ALMERIA CEMETERY
(Joins sheet 36)
(Joins sheet 34)
(Joins sheet 41)
T. 21 N.
2 110 000 FEET
2 130 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000

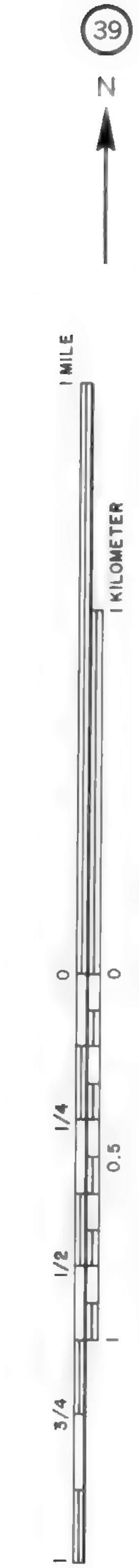

36
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 31)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 42)
R. 19 W.
R. 18 W.
T. 21 N.
NORTH
LOUP
RIVER
Taylor Dam
TAYLOR-ORD
CANAL
Spring
Creek

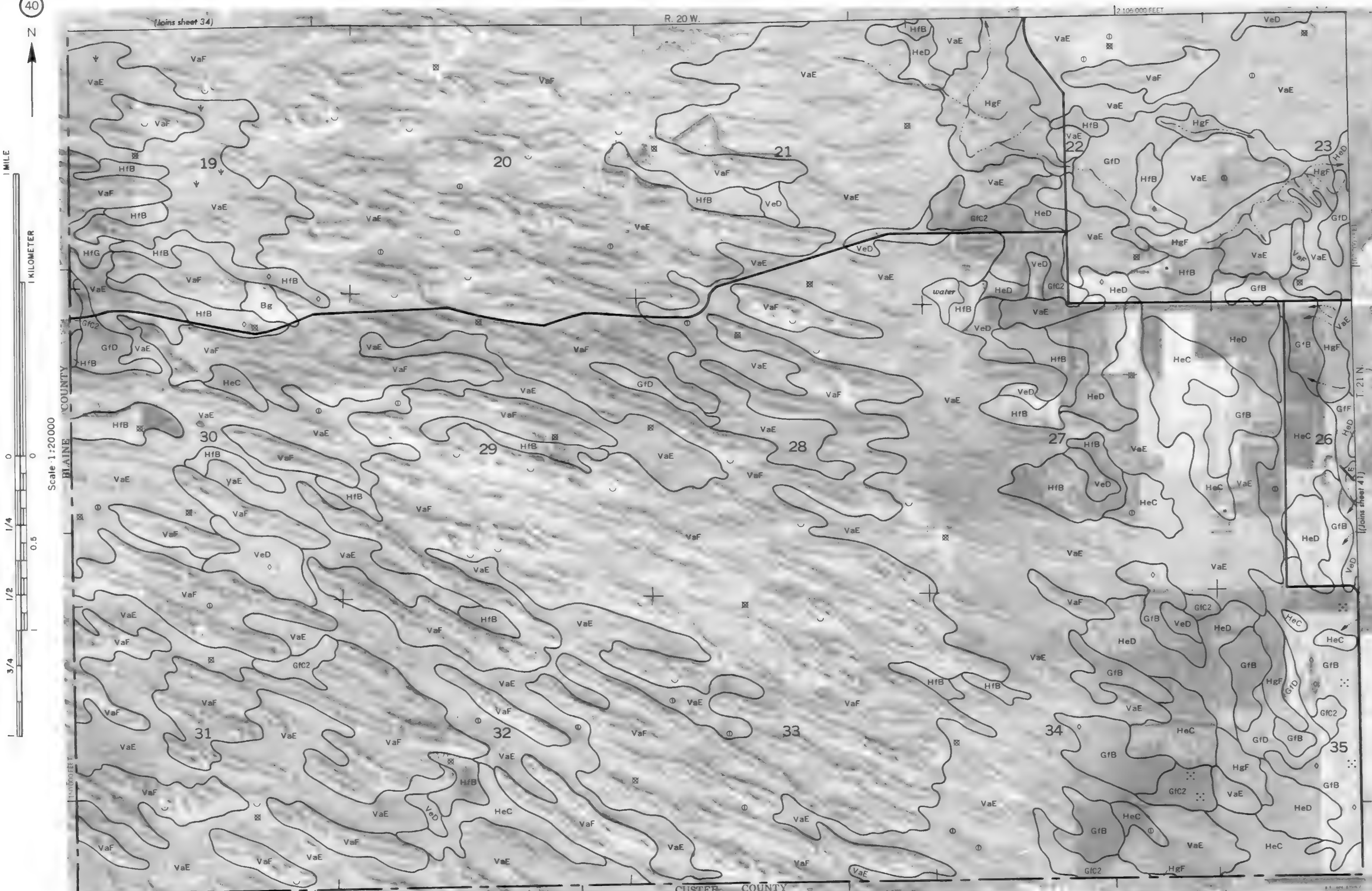

37
N
(Joins sheet 32)
(Joins sheet 36)
(Joins sheet 38)
(Joins sheet 43)
R. 18 W.
T. 21 N.
2 160 000 FEET
180 000 FEET
170 000 FEET
2 180 000 FEET
183
NORTH LOUP RIVER
Tower
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0.5
Scale 1:20000

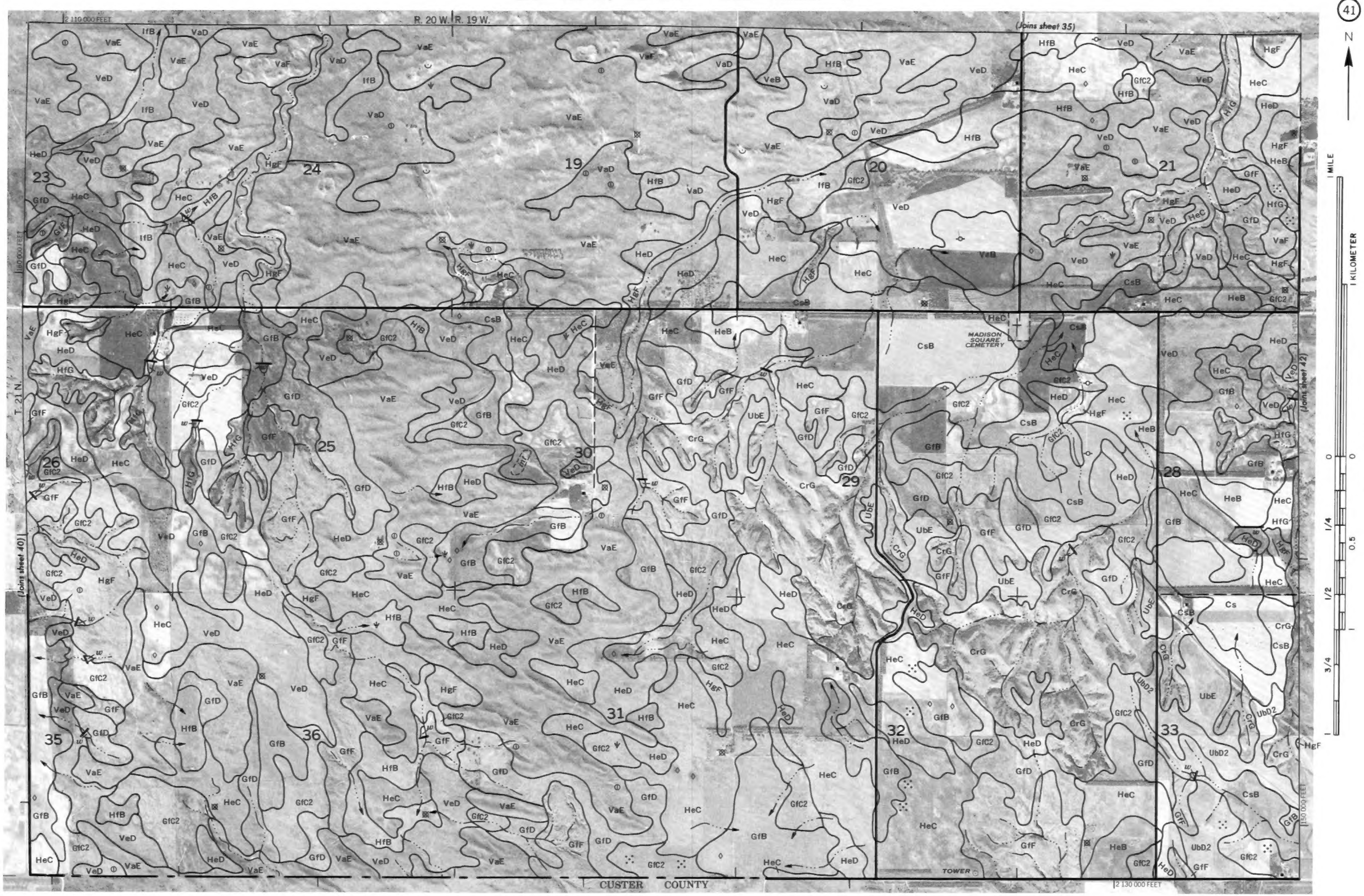

38
N
(Joins sheet 33)
R. 17 W.
T. 21 N.
(Joins sheet 39)
(Joins sheet 44)
(Joins sheet 37)
Scale 1:20000
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0
0.5
1
Cedar
Creek
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18

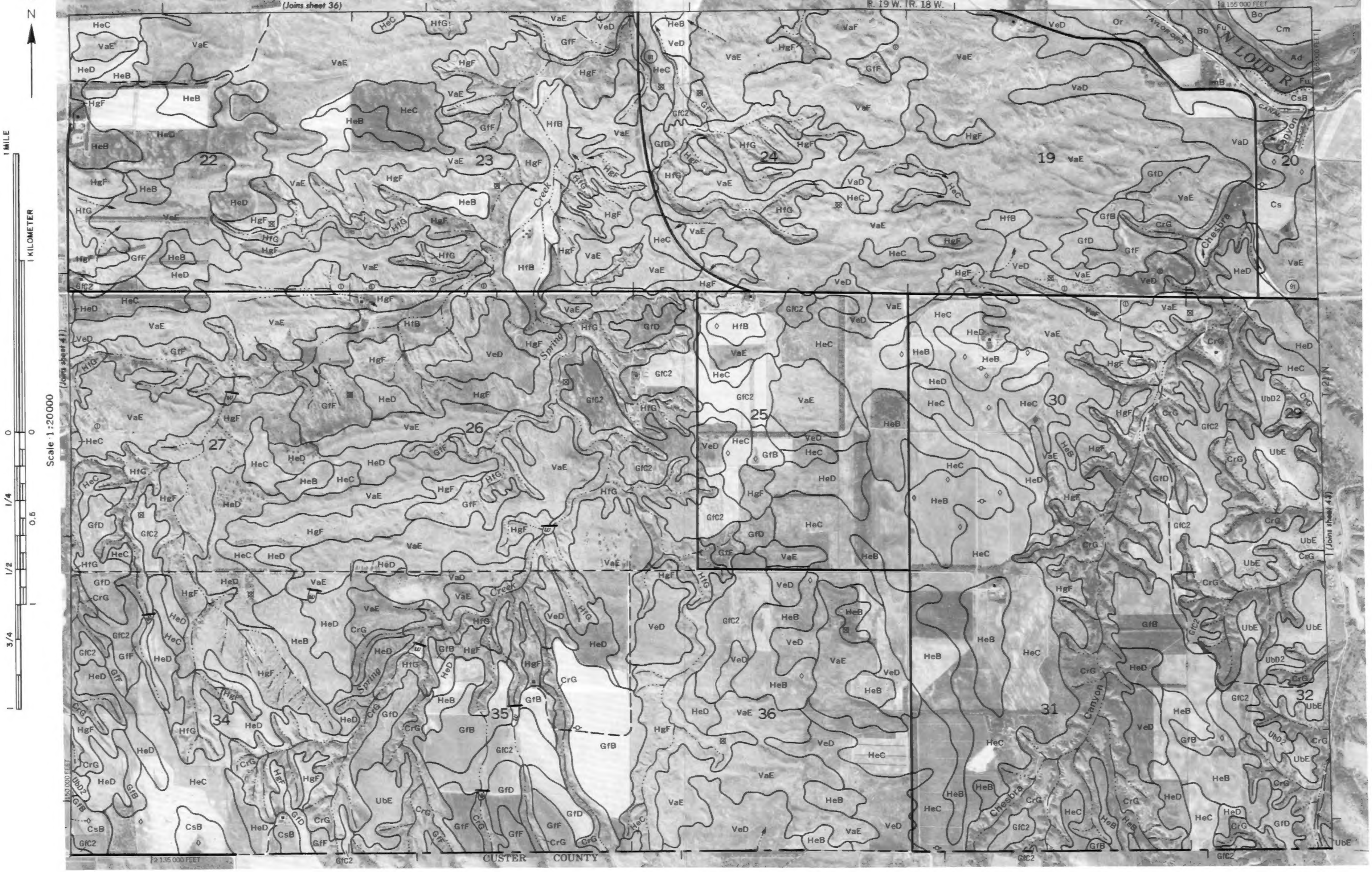

R. 17 W. (Joins inset, sheet 28)
T. 21 N.
(Joins sheet 38)
(Joins upper right)
GARFIELD COUNTY
1
2
11
12
13
14
VaF
VaE
VaD
HfB
IfB
GfC2
GfD
CrG
HgF
HeC

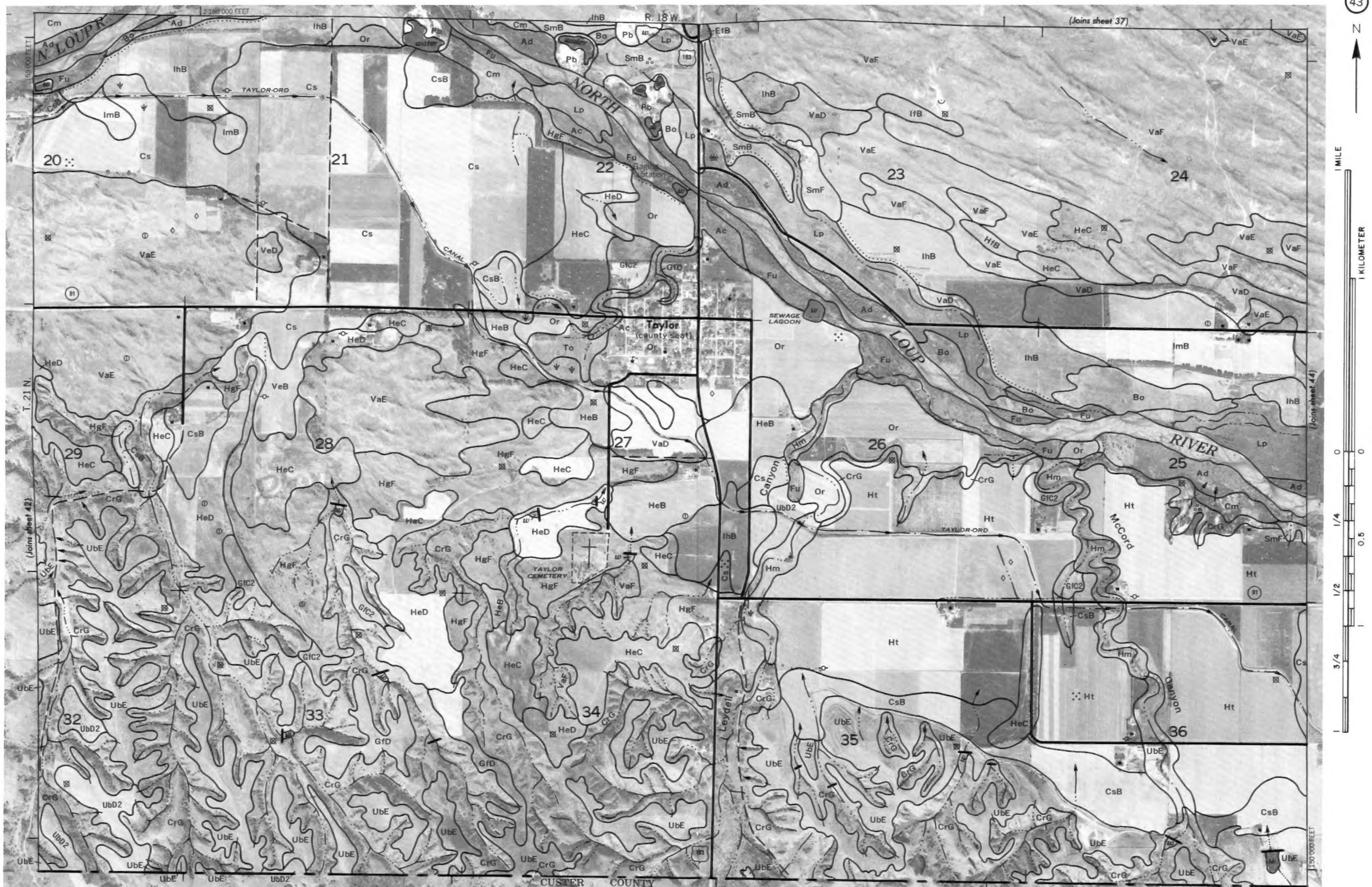

R. 17 W. (Joins lower left)
T. 21 N.
(Joins sheet 44)
GARFIELD COUNTY
CUSTER COUNTY
NORTH LOUP RIVER
Sioux Creek
Siphon
TAYLOR-ORD CANAL
23
24
25
26
35
36
VaF
VaE
VaD
HfG
HfB
IfB
ImB
IhB
CsB
Cm
Ad
Bo
Lp
Po
Ht
Fu
Hm
Or
UbE
UbD2
GfD
GfC2
CrG

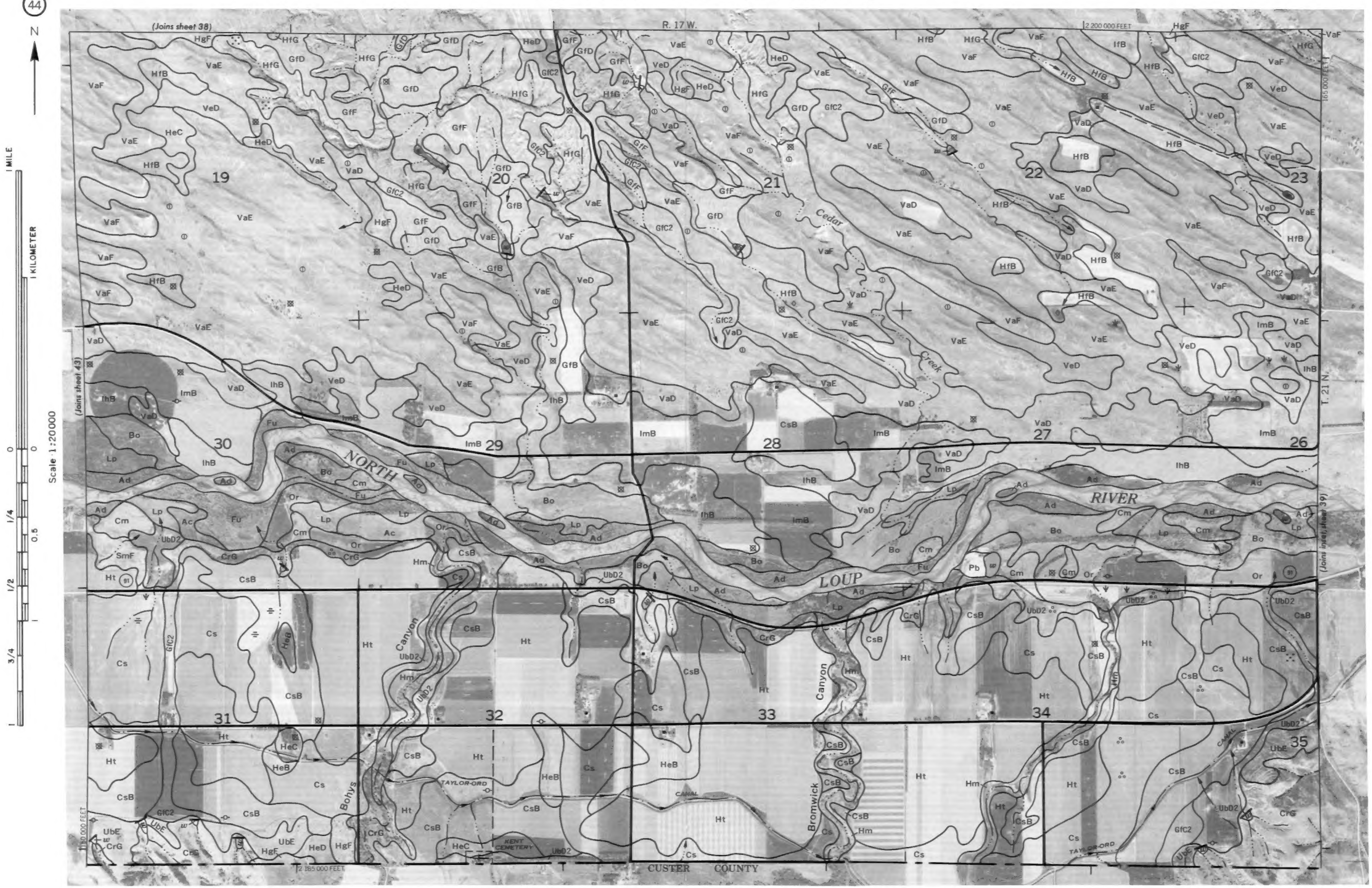

39
N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:20000


(Joins sheet 34)
R. 20 W.
2 105 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
BLAINE COUNTY
T. 21 N.
(Joins sheet 41)
CUSTER COUNTY
2 090 000 FEET
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
water
VaE
VaF
VeD
HfB
HfG
HeD
HeC
HgF
GfD
GfB
GfC2
GfF
Bg


41
N
2 110 000 FEET
R. 20 W.
R. 19 W.
(Joins sheet 35)
(Joins sheet 42)
(Joins sheet 40)
T. 21 N.
160 000 FEET
150 000 FEET
2 130 000 FEET
MADISON SQUARE CEMETERY
TOWER
CUSTER COUNTY
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 36)
R. 19 W.
R. 18 W.
N LOUP R
TAYLOR GRID
CANAL
Canyon
Chesbra
Spring
Creek
(Joins sheet 41)
(Joins sheet 43)
T. 21 N.
CUSTER COUNTY
2 135 000 FEET
155 000 FEET
150 000 FEET
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36


43
N
(Joins sheet 37)
(Joins sheet 44)
(Joins sheet 42)
R. 18 W.
T. 21 N.
N. LOUP R.
NORTH
LOUP
RIVER
Taylor
(county seat)
SEWAGE LAGOON
TAYLOR CEMETERY
CANAL
TAYLOR-ORD
McCord
Canyon
Leydell
CUSTER COUNTY
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
1 MILE
1 KILOMETER
Scale 1:20000
2 180 000 FEET
2 160 000 FEET
150 000 FEET


44
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 38)
R. 17 W.
2 200 000 FEET
165 000 FEET
(Joins sheet 43)
T. 21 N.
(Joins inset, sheet 39)
NORTH
LOUP
RIVER
Cedar
Creek
Canyon
Bohys
Canyon
Bromwick
Canyon
TAYLOR-ORD
CANAL
KENT CEMETERY
2 185 000 FEET
CUSTER COUNTY
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35